

UNIVERSITY OF CAPE TOWN

DEPARTMENT OF MECHANICAL ENGINEERING

PRODUCTIVITY IN CONSTRUCTION CONTRACTING

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SUMMARY

Increases in productivity in construction contracting since 1960 have not been proportional to the large amounts of money spent on mechanization and on the training of labour. Little consideration has been given during this same period to behavioural techniques and the motivation of manpower and it was therefore felt that the adoption of a behavioural approach would result in a significant increase in productivity in the industry. Since any behavioural theoretical generalization requires empiric information about any particular situation, it was necessary to collect data on certain socio-organizational characteristics of construction contracting. Data was collected mainly by means of two attitude questionnaires distributed amongst middle to lower management personnel employed in main contractor and sub-contractor companies in the Western Cape. The analysis of the data centred on the socio-organizational characteristics of contracting, their effect on motivation to obtain increased productivity on both the macro and micro levels, and the relationships between main contractor and sub-contractors. It was apparent that ample scope still existed for the development of behavioural management techniques in construction contracting.

### ACKNOWLEDGEMENTS

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## CHAPTER 1 - INTRODUCTION

### 1. INTRODUCTION TO PRODUCTIVITY IN CONSTRUCTION CONTRACTING

A behavioural analysis of middle to lower management in construction contracting was undertaken to investigate behavioural factors affecting productivity in the industry. Though large amounts of capital have been spent on mechanization, and training schemes have been implemented, there has been no significant movement towards the use of behavioural skills to increase productivity. The analysis therefore centres on the 'human factors' which influence performance; these factors are particularly relevant because of the labour intensive nature of construction.

The study centred on the functions of middle to lower management in construction contracting and included both main contractor and sub-contractor organizations. While behavioural techniques have been used in other industries, the absence of behavioural research material in construction contracting necessitated the collection of empirical information. This information, together with many generalized theories, has been used to seek information about behavioural factors in order to increase productivity in construction contracting.

The construction contracting industry is commonly thought of as inefficient, an opinion often conceived as a result of the dirty, noisy and disorganized appearance of most construction sites. A statistical analysis of construction compared with the manufacturing industry proves this to be untrue.

People involved in construction contracting in South Africa vary considerably in their backgrounds and education; additionally, construction projects are normally a one-off manufacturing process and new work groups are formed for every project.

It is therefore surprising to find that the construction industry had the same increase in productivity as manufacturing over the period 1960 to 1972.



## 1.1 A COMPARISON OF PRODUCTIVITY IN CONSTRUCTION AND MANUFACTURING

Various definitions of productivity exist, though it is often quoted as 'a measure of the output obtained from standard resources' (Ref. 1).

A crude indicator of productivity previously used in construction has been that of 'value added per capita' (Refs. 3, 4). This ratio measures the output of the industry in Rands in relation to the number of people employed in it. The conclusions drawn by this usage have been (Ref. 4):

- i) Productivity in the construction industry in the period 1946 to 1960 has increased by 76 per cent;
- ii) The rate of increase in productivity in the construction industry has not been as great as in the manufacturing industry.

However, a productivity ratio should measure the utilization of available resources and the formula of 'value added per capita' does not take into account the two following considerations. One is the cost of capital expenditure on industrialization or mechanization of the industry, and the other is that the cost of manpower is a relevant factor.

A revised definition of productivity is therefore:

$$\text{PRODUCTIVITY} = \frac{\text{NET OUTPUT IN RANDS}}{\text{TOTAL COST IN RANDS OF WAGES AND CAPITAL EXPENDITURE ON MACHINERY}}$$

The above ratio takes into account the cost of resources utilized the most i.e. manpower and machines. These are related to the net output of the industry giving both the numerator and the denominator in money terms.

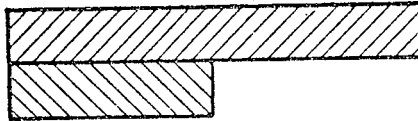
Fig. 1/.....

Fig.1

COMPARISON OF CONSTRUCTION  
vs  
MANUFACTURING [1960 - 1972.]

Net Output

Construction  
Manufacturing



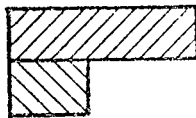
Increase by  
a factor of.

3,80

2,41

Total Employment

Construction  
Manufacturing

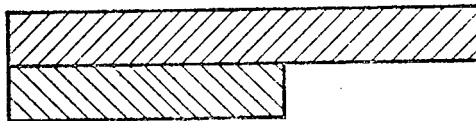


1,78

0,78

Total Wages

Construction  
Manufacturing

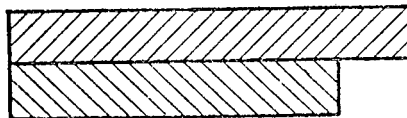


4,36

2,46

Capital Expenditure

Construction  
Manufacturing

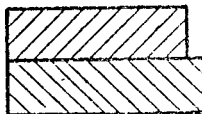


3,68

3,01

Productivity Ratio

Construction  
Manufacturing



0,32

0,35

To achieve/.....

To achieve a more detailed analysis of the performance of the two industries other factors are considered; they are the figures of:

- i) Net output
- ii) Employment and per capita income
- iii) Capital expenditure on plant
- iv) Productivity ratio

The figures used are from the statistics of the years 1960 to 1972 available for the construction and manufacturing industries (Ref. 5). The initial date of 1960 is taken because since then the Republic of South Africa has experienced a particularly rapid increase in the tempo of industrial development.

The construction industry has experienced greater growth than the manufacturing industry; in fact the increase in NET OUTPUT in construction has been 58% greater than that experienced in the manufacturing industry (Figs. 1 & 2).

During the same period the construction industry has retained its labour intensive character even though the capital expenditure on plant in construction has increased at a greater rate than that of the manufacturing industry (Figs. 1 & 2). Also, even though remaining labour intensive, the PER CAPITA INCOME in construction grew at a smaller rate than that experienced in manufacturing. This trend continued during the 1972 - 1975 period (Ref. 6), when per capita earnings in construction increased by a ratio of 2,80 compared to 5,73 in manufacturing.

Both industries have thus grown considerably over the period 1960 to 1972, but the use of a productivity ratio, which takes into consideration net output together with the cost of machines and manpower as the denominator, shows no marked increase in productivity. In fact, use of the above PRODUCTIVITY RATIO gives an increase of productivity in construction of 32% and of 35% in manufacturing.

Fig 2.

**Statistics :**     Construction vs Manufacturing (Ref.5)

	<u>Construction</u>				<u>Manufacturing</u>		
	1960	1972	INCREASE BY FACTOR		1960	1972	INCREASE BY FACTOR
Net Output. [Million Rands.]	135, 6	651, 2	3,80		1098,5	3749,1	2,41
Total Employment. [Thousands.]	125, 6	349, 4	1,78		636,0	1131,0	0,78
Total Wages. [Million Rands.]	86, 9	465, 9	4,36		509,4	1760,3	2,46
Capital Expenditure. [Million Rands.]	6, 9	32, 47	3,68		126,8	508,6	3,01
Productivity Ratio.	0,99	1,31	0,32		0,96	1,30	0,35

It therefore/.....

It therefore appears that even with the increase of knowledge regarding new techniques and the availability of new machines, there has not been a substantial increase in productivity in the two industries. Further training of labour and increased mechanization can further increase productivity in construction, but behaviouralists believe these two factors alone will not necessarily result in increased efficiency in the industry (Refs. 30, 33, 43, 48).

## 1.2 PREVIOUS ATTEMPTS TO INCREASE PRODUCTIVITY BY MECHANIZATION AND TRAINING

All production processes require a total number of manhours or machine-hours of uninterrupted work to complete a process, which we call the TOTAL WORK CONTENT. However, additional time is often required to complete a function. This additional time, due to stops in machine or man production, is defined as the INEFFECTIVE TIME required (Fig. 3).

$$\text{TOTAL TIME REQUIRED} = \text{TOTAL WORK CONTENT} + \text{INEFFECTIVE TIME}$$

Total work content is therefore dependent on the process required, its design or specification and the inefficient methods of manufacture or operation used while the ineffective time is dependent on the shortcomings of 'human management'.

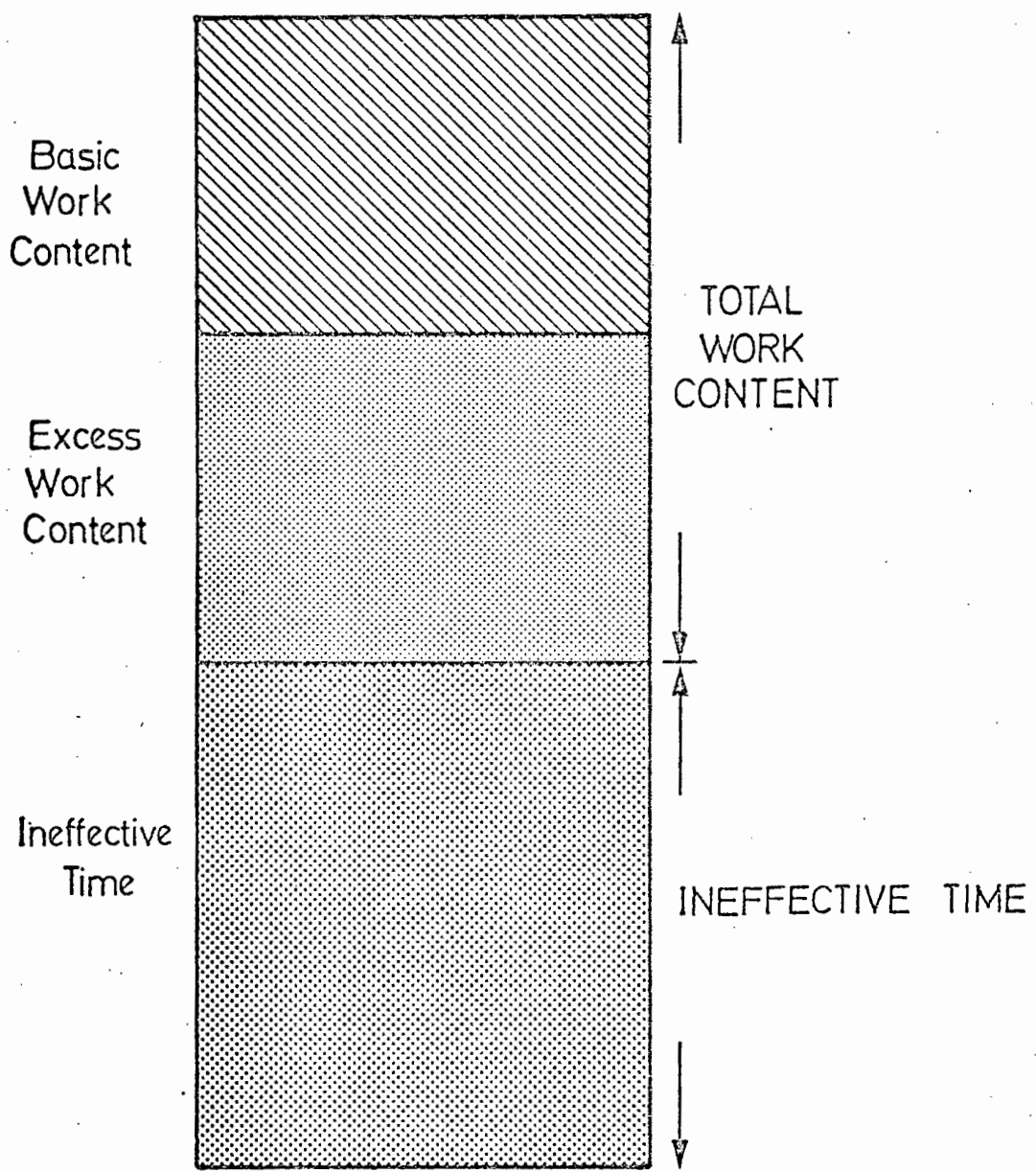
The initial attempts at increasing productivity by a reduction of the total time required to complete a process began with the movement towards scientific management in the late 1800's (Ref. 2). The SCIENTIFIC MANAGEMENT school of thought, which is often associated with Frederick W. Taylor, sought to increase productivity by:

- i) Making the work easier to perform through labour-saving devices and techniques;
- ii) Trying to motivate the workers to use the improved techniques by numerous wage payment plans.

Fig. 3/.....

Fig 3

# Time Required for Production.



In the/.....

In the building context it is of interest to note that in the first time-and-motion studies Frank Gilbreth analysed the technique of bricklaying (Ref. 2). He tried, by means of his analysis, to reduce the number of motions required by a brick-layer and succeeded in reducing the number of motions for laying exterior brick from 18 to  $4\frac{1}{2}$  and for interior brick from 18 to 2. He then continued to develop an adjustable stand to eliminate the stooping required to pick up bricks. By the above means and the use of a proper mortar, to eliminate the tapping of bricks, he was able to increase the number of bricks a man could lay in an hour from 120 to 350.

Previous attempts at increasing productivity in construction contracting in South Africa have been based on the philosophy of scientific management. The 30% increase in productivity in construction contracting is largely due to:

- i) An increase in mechanization;
- ii) An improvement in the training of the labour force.

The rate of MECHANIZATION of the South African Construction Industry over the period 1962 - 1972 has been greater than that experienced in the United Kingdom (Ref. 7). Capital expenditure on machines in construction in the United Kingdom increased by a factor of 2,5 compared to a figure of 3,7 in South Africa over the same period.

The increase of mechanization in South Africa has occurred in the following ways:

- i) Industrialization of construction techniques by transferring work to the factory;
- ii) The introduction of mechanical aids for use by skilled and unskilled workers involved in traditional construction techniques.

South African/.....

South African developments in the application of 'factory-type' industrialization techniques have not been as rapid as in the case of developed countries, but the construction industry has kept up to date with traditional in situ systems and those of partial prefabrication (Ref. 4). In fact, South Africa is regarded as a world leader in the field of mass housing using both in situ and partial prefabrication techniques.

A superficial evaluation of the effects of mechanization in construction in South Africa over the period 1960 - 1972 indicates a decrease in the rate of employment in the industry coupled with an increase in net output. However, mechanization comes at a cost, both in capital expenditure on machines and in the quality of labour required to operate the machines.

A more detailed analysis of the overall efficiency of the industry over the same period shows a very small increase of 30% in productivity. The decrease in the rate of employment by a factor of 1,78 has been accompanied by a wage rate increase by a factor of 4,38.

It has been suggested that apart from mechanization a more efficient utilization of manpower on construction sites should result in increased productivity. This can be achieved by teaching the individual more skills, but the lack of skilled labour is often diagnosed as one of the major problems of the industry (Ref. 13). The industry has therefore instituted training programmes, though it is estimated that less than 10% of the employees have been formally trained which is inadequate for the high turnover of labour experienced in the industry.

Existing TRAINING schemes take place in the form of in-company training courses and other training programmes arranged through BIFSA (Building Industries Federation of S.A.) and CEITB (Civil Engineering Industries Training Board). The training courses or 'packages' offered by the two institutions generally aim at a more efficient use of mechanical aids or the improvement of manual skills. Both institutions are still new and have not



made as much progress in this direction as the manufacturing industry. In fact, the training schemes were only extended to cover all Civil Engineering contractors five years ago (Ref. 12).

In contrast to the optimistic attitude of those backing the existent training programmes, others are more sceptical as to their effect in increasing overall productivity. S.E. Dawson, past President of the Federation of Civil Engineering Contractors, is convinced that the better and more expensive training schemes have not been accompanied by a proportional growth in labour productivity in the civil engineering field (Ref, 14).

In answer to the above opinion the behaviouralist counters that output is proportional to ability and motivation (Ref, 32).

$$\text{OUTPUT} = \text{ABILITY} \times \text{MOTIVATION}$$

Thus, even if a man has been trained to do a job more efficiently, this alone is not sufficient to improve his output because the individual must also be motivated to work. This is the largest pitfall existing in the building and construction industries. Until effective motivation management techniques are introduced into the industry, there cannot be a significant increase in productivity.

### 1.3 THE BEHAVIOURAL APPROACH AND ITS APPLICATION

The behaviouralist believes that the execution of any task is also dependent on the motivation of the person doing the task (Refs. 31, 32, 33, 43) and manpower fulfills a central function. Not only is manpower responsible for the execution of various tasks, but it is also responsible for the efficient utilization of resources available to an enterprise; its motivation is therefore very important.

About 60 years ago Hugo Munsterberg noticed that efficiency engineers placed a greater emphasis on physical skills, neglecting the psychological or mental skills (Ref. 2). His investigations

were the/.....

were the beginning of industrial psychology, a science which investigates the human side of production processes.

Further work was undertaken by Elton Mayo (Ref. 2) who through his various studies and famed Hawthorne Experiments 1924 - 1932, discovered that increased output could be obtained by other means than scientific management techniques. He found that both individual and group behaviour affected production, while the supervisory climate was also found to be relevant to output. Thus evolved the Behavioural School of Management which recognized the role of the individual in the management process.

The manufacturing industry was quick to implement some of the behavioural management techniques. While the motor car industry thought it had reached a pinnacle of efficiency in Henry Ford's assembly line, it has now moved away from the extreme specialization of mass production.

The Renault car manufacturing company, together with other manufacturers, has combined social science with economics in an effort to increase productivity. Renault discovered that their system of 'humanized work' led to an increase in production (Ref. 15).

Renault initially used the conventional mass production assembly line. This was changed to a system of group assemblies whereby a group of individuals working together performed complete engine or suspension assemblies. Group assembly allowed the workers greater freedom, an increased opportunity to use their initiative and increased the individual's job content to four times greater than previously.

In the application of the new scheme the biggest problem was not getting people used to more complicated jobs, but getting them to accept new ideas. The foremen especially showed great

opposition/.....

opposition, largely due to a feeling that their jobs were being threatened.

Group assembly also involved a further capital investment which is, however, never as great as that required by full automation. After the change to group assembly and 'humanized work' there was a reduction in absenteeism and an increase in production.

There are numerous examples of productivity being increased by behavioural techniques in the manufacturing industries, but this does not apply to the construction industry. Even in the United States, the leader in management techniques, there has been no large scale study or use of the behavioural approach in construction.

A certain amount of research into the behavioural aspects of management in construction has been undertaken at the Department of Civil Engineering at Stanford University in California (Refs. 23, 24, 25). Others, amongst them Charles Schroder of the Proctor and Gamble Company, Cincinnati, (Ref. 22) have also done studies on the motivation of construction workers.

The criticism often levelled at these studies has been that much of the work was based on social psychology experiments conducted in white collar bureaucracies, manufacturing assembly lines and other industries. It is held (Ref. 25) that 'people problems' in construction differ from those in other industries.

Exploratory investigations regarding productivity and job satisfaction in construction were undertaken in a study sponsored by the Construction Institute of the Department of Civil Engineering at the University of Stanford (Ref. 23). This was followed by one on job dissatisfaction in construction work (Ref. 24). The investigations were based on Frederick Herzberg's theories on motivation and on articles by Likert and Vroom. The implicit assumption is that job satisfaction will result in an increase in productivity.

The research/.....

The research methodology constituted a series of sixty-five in-depth interviews of management and labour at St. Louis, Los Angeles and San Francisco. These were followed by a rank ordering of the job satisfiers, together with a table of the contributing factors. Tentative recommendations on how to produce satisfaction were then tabled.

The behavioural approach has already been adopted by a few American firms involved in construction. The Tennessee Valley Authority (Ref. 27) has begun a system of joint employee-management decision making in its Planning and Engineering Division and has also introduced a system of verbal employee evaluation.

To date no formal study has been made of the behavioural aspects of workers in construction in South Africa. The National Productivity Institute has undertaken an investigation of the efficiency in the building and allied industries (Ref. 29), but to date the investigation has largely ignored the behavioural approach in its analysis.

The South African construction industry offers a vast and exciting field for behavioural techniques because of the wide variety of ethnic, educational and religious groups it comprises. Not only are there a great number of different groups, but their positions in the construction project's hierarchy will vary considerably with the geographic position of each particular site.

Geographic positioning of a construction site will be an important factor affecting the site's social interactions. This is because geographic position affects the structure of the working organization and the ethnic mix of people employed. The reason for this can be attributed to:

- i) The availability of suitable manpower in the area;
- ii) The cost of the local manpower versus the imported;
- iii) Government and building industry agreements regulating conditions of employment.

In/.....

In the Western Cape the type of manpower available and the functions performed by each ethnic group differ from those in other sections of the country. Supervisory work is undertaken by Europeans, Coloureds and Africans, while the work of artisans is performed by Coloureds and a minority of Europeans. The labour employed is primarily Coloured or African.

A further analysis of the Africans employed will show that some are urban and others are migratory workers. Also, while they all have their origin in the Transkei or Ciskei, they belong to different tribes which all have characteristic traits.

An interesting example of a behavioural problem with Black labour was encountered during the building of the Haardap Dam in South West Africa. This is a huge earthdam and its construction involved the packing of a large quantity of stone. The labour employed to pack the stone, even after training, was producing work at a low output and of a poor quality. After much thought it was realized that the tribe employed to pack the stones came from a very sandy part of the country. No sizeable stones existed in their part of the country and hence their inaptitude at working with stone. Only after replacing all the labour packing the stone with a group from another part of the country was a satisfactory output achieved.

This marked difference in the individual's background, and consequently in his aptitudes and attitudes, is found at all levels of the construction site hierarchy. The training department of a large national construction company noted that the opinions expressed by their general foremen from one geographic region differed markedly from those of general foremen from another region. Further, the difference was even apparent between general foremen of the same ethnic group and age for areas of the same province, i.e. Western Cape vs Eastern Cape.

Because of the/.....

Because of the particular mix of ethnic, religious and educational groups involved in construction, only certain psychological theories or generalizations may be applied nationally. Any other empiric deductions must take into consideration the geographic position of the experiment.

The geographic constant chosen for the behavioural analysis of construction contracting organizations was the Western Cape. The level at which the investigation was aimed was middle to lower management.

Many large construction and mining houses, often due to socio-political reasons, embark on projects aimed at humanizing the work and motivating the workmen at the lowest end of the ladder. These studies are unlikely to act as stimulants to increased production unless middle to lower management employees, who will supervise the workers, have themselves been motivated to behave functionally.

The mining industry in South Africa has begun with a probe into the perceptions and behaviour patterns of Black mineworkers on a mine. This study was made by a Black research team under Professor Dunbar Moodie, former Professor of Sociology at the University of the Witwatersrand. Further work, which has been applied mostly in the manufacturing industry, has been done on the motivation and understanding of Black workers (Refs. 33,34).

In construction contracting large companies have introduced a system of communication with the Black labourers employed, whereby Black employees elect a committee from amongst themselves. This committee meets on a monthly basis with management and at these meetings can bring up any query, complaint or suggestion.

Though an excellent system, fostering communication and a feeling of participation, the Black Liaison Committee is not a positive motivator. It is therefore improbable that it will cause any

significant/.....

significant increase in productivity.

For behavioural knowledge and behavioural management techniques to contribute positively towards productivity in construction contracting, it is first imperative that top management members should convince themselves of its necessity. Middle and lower management who come into contact with the workers must then be motivated to behave functionally. Empiric knowledge is therefore required in respect of existing socio-organizational variables affecting the behaviour of middle to lower management. This must then be integrated with existing theoretical generalizations regarding the motivation of the individual to behave in such a way so as to improve his efficiency and that of those whom he supervises.

## CHAPTER 2 - THEORY

### 2. THE THEORY OF BEHAVIOURAL MANAGEMENT

In construction the contractor generally executes a task and is not as a rule involved in the design of a project. His aim is therefore to execute his task as efficiently as possible by seeking an optimum blend of people, equipment, procedures and operations. Consequently the contractor seeks to capitalize on the relative capabilities of human beings and of physical equipment available to him (Ref. 30).

To stimulate anyone to work efficiently one must take into consideration the different variables associated with job performance. The variables can be divided into two main categories (Fig. 4):

- a) Individual Variables
- b) Situational Variables

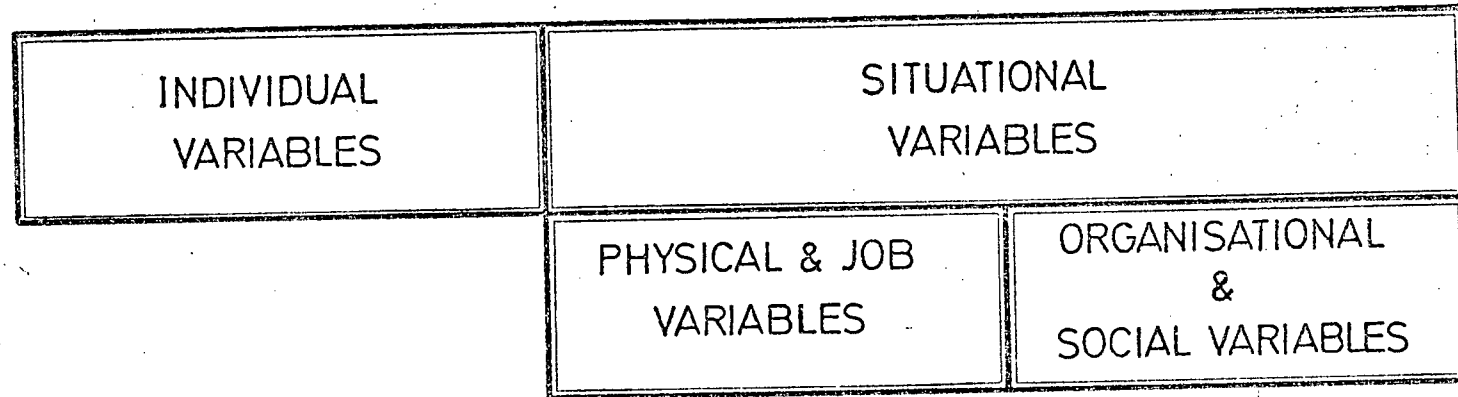
- a) The INDIVIDUAL VARIABLES are those related to the characteristics of the person involved. They are his:

- Aptitudes
- Personality characteristics
- Value systems
- Physical characteristics
- Interest and motivation
- Age and sex
- Education
- Experience
- Cultural background
- Other personal variables

The above variables are mostly formed before an individual becomes part of a contracting organization or project. They are, however, a rigid basis which strongly influences the attitudes and consequent behaviour of the individual on site.



## VARIABLES AFFECTING PERFORMANCE



b) SITUATIONAL/.....

Fig.4

b) SITUATIONAL VARIABLES are those related to the particular work situation and they are the variables most easily changed or influenced by those in charge of a project. The situational variables may be further subdivided into two groups:

i) Physical and Job Variables, which include:

- Methods of work
- Design of work equipment
- Condition of work equipment
- Work space and arrangement
- Physical environment

ii) Organizational and Social Variables, which include:

- Character and policy of the organization
- Type of training and supervision
- Social environment
- Types of incentives offered

The individual variables can be considered short-term constants for the purpose of a construction project, while the situational variables are the ones that must be optimized to increase production on a project.

Scientific management techniques aim at optimizing the physical and job variables affecting production, whilst behavioural techniques are mainly involved with the organizational and social variables. In an analysis of the behavioural variables, the type of training and supervision, the social environment and the types of incentives offered within the company are a function of the character of the particular organization. The character of construction contracting organizations is therefore an important variable affecting the performance of the company.

## 2.1 CONSTRUCTION CONTRACTING ORGANIZATIONS

Projects in building and construction vary considerably in size and complexity. Those projects of a low value and complexity are normally executed by the smaller companies who have no need for sophisticated management techniques. Their management

process/.....

process takes place mainly by means of interpersonal relations amongst the members of the company. However, the increasing complexity and large number of resources required on the bigger projects have resulted in:

- i) The subdivision and specialization of activities and hence the formation of multitudes of sub-contractor companies;
- ii) The growth of large main contractor organizations that also co-ordinate the activities of all the sub-contractors.

Large South African construction companies can have up to 30 000 employees and their growth has required the development of formal organizational structures. The organizational structure defines the company's hierarchical structure, the procedures to be adopted and its formalized lines of communication.

Top management will reflect its attitudes in the formation of the company's organizational structure and will consequently give it a certain character. One may then categorize the characters of various organizations into three general groups (Ref. 32):

- a) Those paternalistic in nature;
  - b) Those adopting scientific management philosophies;
  - c) Those adopting participative management philosophies.
- 
- a) PATERNALISTIC organizations try to make membership of the organization a source of reward. Rewards are thus not dependent on performance and employees will get what they want through their enthusiasm and loyalty to the organization.
  - b) SCIENTIFIC MANAGEMENT organizations use rewards as a source for motivating performance, with the rewards based on an external control system. A management subscribing to this system may be considered to belong to Douglas McGregor's Theory X line of

thought/.....

thought (Ref. 2) where man is assumed to be a rational creature who works for a maximum amount of money with the least effort; sometimes known as 'Economic Man' (Ref. 31).

Organizations which adopt the Theory X or scientific management techniques will tend to be highly structured. In the ideal form the structure would have five main characteristics:

- i) Clear cut division of labour resulting in specialized experts;
- ii) Hierarchy of offices, each one controlled and supervised by the one above;
- iii) System of abstract rules and standards ensuring uniformity of performance;
- iv) A spirit of formal impersonality in which people carry out their duties;
- v) Employment on technical qualifications protected from arbitrary dismissal.

The five points are those of an ideal bureaucratic organization as defined by the German sociologist, Max Weber.

- c) PARTICIPATIVE MANAGEMENT organizations give significance to the group and man's sometimes illogical behaviour. This management style is sometimes referred to as the Theory Y system and motivation is primarily by worker involvement. The group is also used as a problem solving and decision making unit.

The emergence of the participative management style is largely a result of the continuously changing work environment facing companies. Some behaviouralists feel (Ref. 2) that organizational structures should be more flexible and that this more adaptive structure would lead to greater synergism within the organization.

Each large/.....

Each large construction company has a particular organizational character, reflecting top management's attitudes which permeate down the line. However, the strength of management's directives weakens with long lines of communication and consequently individual projects may develop their own particular character different from the character of the main organization.

On medium to large size construction contracts a project organization is formed. Due to the large autonomy often given, or taken, by the project manager or site agent the type and structure of the project organization is an important factor influencing site performance.

The organizational structure of a construction project generally consists of a site agent/general foreman who controls his resources of labour, machines and materials through various foremen or leading hands. The site agent will therefore structure his project team, the hierarchy of command and the various procedures to be performed according to his own style of leadership or supervision. There is, however, another large group of individuals who will be influenced by the character of the project organization - they are the sub-contractors.

On a building contract the sub-contractor may account for 65% of the building costs (Ref. 39). The mechanism of how to incorporate him effectively into the project is thus relevant to overall productivity of a contract.

#### 2.1.1 Sub-Contractor Organizations

Many studies have been undertaken on productivity in construction contracting. There has, however, been no focus on the role of the sub-contractor in construction projects; yet his role and the function of integrating him into the project forms a major part of any medium to large sized contract.

The construction/.....

The construction project may comprise civil, mechanical, chemical and electrical fields of engineering and all these different operations have to be co-ordinated by a single entity. Traditionally this is done by the main contractor who is normally directly involved in only the civil or building activities.

The increasing number of activities involved in a contract complements its technical complexity; in addition the work content for each activity tends to fall as the number of activities that are simultaneously taking place rise to a maximum (Ref. 36, Fig. 5), and it therefore becomes difficult to allocate resources to achieve the sequence of activities essential to the project.

The sub-contractor is the product of the numerous technical fields and types of activity required on a project. He is normally a specialist and thus offers the particular advantages of specialization. However, he is often in conflict with the aims of the various projects on which he is involved.

The aim of the sub-contractor is to build an efficient work force, a pre-requisite of which is the provision of continuity of work. To obtain this he must be involved on more than one project at once and therefore his sequencing of resources may be in conflict with the schedules of the various projects in which he is participating. The sub-contractor organization, therefore, must be structured so that it may be efficiently integrated into the construction project and yet may still fulfil its own objectives.

The simplest form of sub-contractor organization is a small group of individuals who perform a single specialist construction operation. The aim of this group is centred around planning, organizing and controlling this function. This small group of people may belong to a single enterprise or may be a semi-autonomous section of a parent company.

## Pattern of Activities for a Project

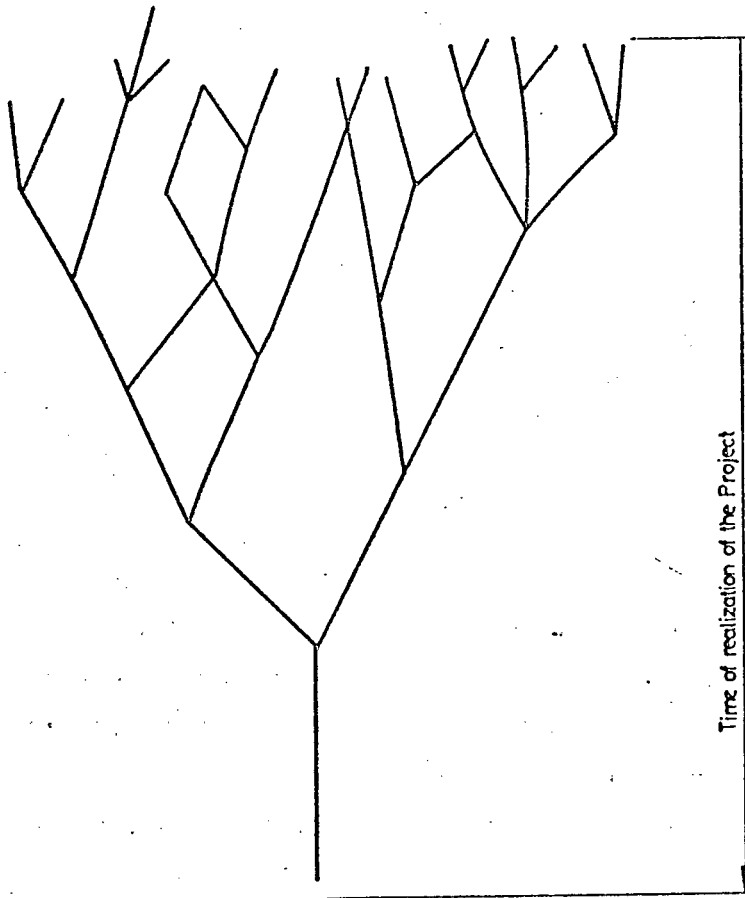


Fig.5

The involvement/.....

The involvement of small groups of people allows inter-personal communication amongst members of the group and a quick feedback of information. But, even though an efficient inter-group relationship may exist, this is not necessarily the case in the group's relationship with other organizations. Sub-contractor organizations may therefore be efficient within their structure, yet they may be inefficient in the overall context of a construction project.

Also, due to the complexity of certain tasks (e.g. air-conditioning) sub-contractors are often further dependent on their own sub-contractors and numerous suppliers. Sub-contractor organizations are therefore at times also required to act as co-ordinators in their particular sphere of operation. However their specialization in a particular construction task enables them to keep in regular contact with their suppliers.

Consequently, the role and structure of sub-contractor organizations is different from that of the main contractor companies. They must therefore be considered independently, both in their relationship with the main contractor and in the function of their own organizational operation.

The character of an organization and its related structure is a situational variable which affects the performance of the worker on a macro scale by influencing the type of supervision, training and the social environment found in the company. It is also necessary, especially in the context of a construction site, to stimulate the individual to work on a micro scale. This may be achieved by applying behavioural models or theories which try to relate the different variables which affect an individual's performance.

## 2.2 MOTIVATION OF THE INDIVIDUAL

It is difficult to stimulate anyone to work unless one knows how that person is motivated and to which incentives he will respond.

Numerous/.....



Numerous theories have evolved which analyse man's behaviour and the reason why he works. It is felt by many that money is the prime reason why men work. However, numerous studies undertaken by researchers have confirmed that work serves a very important non-economic factor.

Nancy C. Morse and Robert S. Weiss (Ref. 41) in their study of middle and working class workers stated that work serves a non-economic function. They considered that the importance of a job in non-monetary terms is best gauged by considering whether one would still do the same job if one no longer had to earn a living. They concluded that work gives men the feeling of being tied to a larger society and that having something to do gives them a purpose in life.

In this connection it is interesting to note the Buddhist viewpoint regarding the function of work (Ref. 9). This is three-fold: to give a man a chance to utilize and develop his faculties; to enable him to overcome his egocentredness by joining with other people in a common task; and to bring forth the goods and services for a becoming existence. Many of the recommendations of modern industrial psychologists are encompassed in the above.

A.H. Maslow in his paper 'A Theory of Human Motivation' (Ref. 42) defines man as a perpetually wanting animal, and he classifies the needs as:

- Physiological
- Safety
- Social
- Ego
- Self-actualization

The average member of our society is most often partially satisfied and partially dissatisfied in the above needs.

The individual/.....

The individual seeks to satisfy his own personal needs, both directly and indirectly through his work, and man does not render his services merely for money. Non-economic payment is thus relevant to the work situation because productivity is the result of many complex factors, which are due to individual and situational variables involving rational and non-rational behaviour.

The various theories and models that have been developed fall into various general groups. Two significant theoretical groups which attempt to explain man's behaviour are those related to the drive theory and those related to the cognitive theory.

The drive theory is based on hedonism, the fact that people try to maximize their pleasure and minimize their pain through life. It postulates that motivation = habit strength x drive where habit strength is due to the reinforcement from previous rewards and drive is the result of internal stimuli.

The cognitive theory is based on utilitarianism, whereby people calculate the effect of their actions and maximize the net return. People's behaviour is dependent on their cognition of the situation and the valence or importance of the expected outcome. In this theory there is more stress on the anticipation of future rewards than there is in the drive theory. A further development has been the combination of different aspects of the two theories which has resulted in a new theory.

### 2.2.1 The Effort Performance Model

The combination of and development of the drive and cognitive theories has resulted in the development of a new behavioural model where the performance of a task is defined as the result of:

- i) The effort of the individual
- ii) His abilities (intelligence, aptitude)
- iii) His role perception

This/.....

This conceptual model was derived by Edward E. Lawler and Lyman Porter (Ref. 43). It also defines effort as being dependent on:

- i) The value of rewards;
- ii) The probability of the rewards depending upon effort.

The above theory has been further refined (Ref. 33) resulting in a conceptual framework suitable for the development of incentive schemes in any particular work situation (Fig. 6) (Ref. 33).

The conceptual framework of the EFFORT - PERFORMANCE MODEL can be broken down into three main sections: the determinants of effort, performance and satisfaction.

#### DETERMINANTS OF EFFORT

The motivation of a worker to perform at a given level is dependent on two cognitive variables. The first is the worker's belief concerning the probability that if he puts effort into performing at a given level, he will be able to perform at that level - denoted as (E-P) or expectancy - performance in the model.

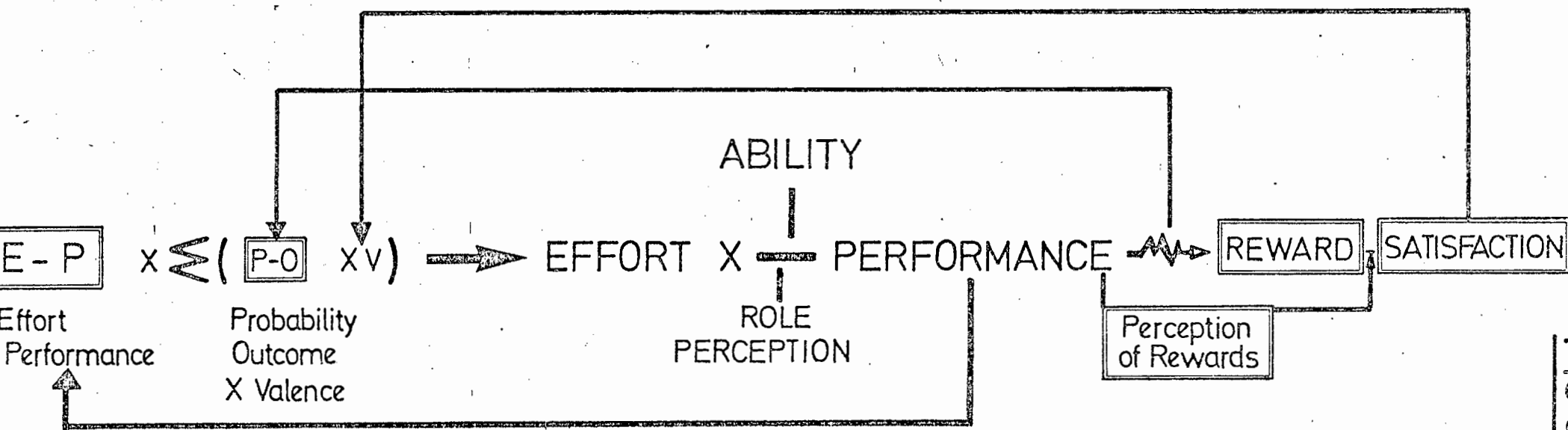
The second variable is the belief about the outcomes of the various performances and the importance attached to these outcomes, which is expressed as the summation of performance - outcome (P-O) beliefs, together with the product of the valence (V) thereof.

$$(E - P) \times \text{SUMMATION OF ALL } (P - O) \times V = \text{EFFORT}$$

$$\begin{aligned} \text{Effort Performance} \times \text{Summation of all the Performance} \\ \text{Outcomes} \times \text{their Valences} = \text{EFFORT} \end{aligned}$$

Apart from the direct stimulants to motivation, effort-performance, performance-outcome and valence, there are other indirect stimulants. These are those resulting from performance itself or the

# The Effort Performance Model



satisfaction following performance. The indirect stimulants affect the expectancy beliefs, the individual's performance-outcome and valence, and it is apparent that the model depicts a continuous process with one factor affecting the other.

#### DETERMINANTS OF PERFORMANCE

There are two prerequisites for a good effort to result in effective performance:

- i) The ability to do a job
- ii) The right role perception

$$\begin{array}{ccccc} & & \text{ABILITY} & & \\ & & \text{X} & = & \text{PERFORMANCE} \\ \text{EFFORT} & & & & \\ & & \text{HOW TO DO IT} & & \end{array}$$

Lawler and Porter (Ref. 43) define ability in the model as the individual's currently developed power to perform. The model encompasses such variables as the individual's intelligence, manual skills and personality traits. These features are all relatively stable and long-term and are considered to be relatively independent of immediate environmental circumstances.

The role perception or 'how to do it' is more of a situational variable and determines the direction in which the individual applies his effort. Performance is therefore dependent on the individual's ideas about the kind of activities and behaviour required of him in his job. Role perception is strongly linked with supervision's attitudes and the communication process within an organization.

Performance is the product of the effort, the ability and role performance and this multiplicative interaction has been reviewed in detail by Vroom (Ref. 45) and Lawler (Ref. 44).

Therefore/.....

Therefore even with a good effort, if there is no ability or the role performance is incorrect there will be no efficient performance.

#### DETERMINANTS OF SATISFACTION

The relationship between satisfaction and performance is more complex than is commonly believed. It is often stated that job satisfaction will result in increased production but this is not always necessarily the case.

Arthur Brayfield and Walter Crockett (Ref. 46) in their psychological study of employee attitudes and employee performance concluded:

- i) that satisfaction with one's position in a network of relationships need not imply strong motivation to outstanding performance;
- ii) productivity may be only peripherally related to many goals towards which the industrial worker is striving.

Frederick Herzberg (Ref. 47) in his 'Motivation Hygiene Theory' states that satisfactions resulting from job context are not positive motivators. The model thus used (Ref. 33) shows satisfaction to be the consequence of being suitably rewarded for one's performance:

#### PERFORMANCE - REWARD - SATISFACTION

The reward received can be unrelated to organizational objectives and non-monetary, but the perception of what the rewards should be has an independent effect on the satisfaction received. Therefore, though satisfaction may follow performance, it will still influence the motivation and effort exerted. There is a continuous process whereby the one factor influences the other.

The EFFORT/.....

The EFFORT - PERFORMANCE model in its entirety serves as a useful tool to stimulate workers to greater performance. As the model serves as a generalization, it must be complemented by empiric information about the actual situation before it can be used effectively.

### 2.2.2 Incentive Schemes in Construction

To date the use of incentives in construction has normally been in the form of economic stimulants. As shown in the Effort - Performance behavioural model other non-monetary stimulants can be used. Some form of economic incentive scheme is, however, often the easiest means of trying to motivate workers.

In the United Kingdom and the United States use is made of economic incentive schemes in construction. In the United Kingdom approximately one third of all direct operators are receiving some proportion of their incomes from financial incentive schemes (Ref. 48). The Ministry of Labour's Gazette in September 1961 states that 14% of workers in construction were on a PBR (Payment by Results) scheme. In May 1968 the National Board for Prices and Incomes (Report No. 65 Cmd 3627) produced a report on 'Payment by Results Systems'. This stated that of 150 000 workers belonging to the Federation of Civil Engineering Contractors, 70% were on PBR schemes.

There has been considerable disenchantment with economic incentive schemes and their application in construction. J.K. Evenwel states (Ref. 4) that experience abroad has shown that bonus incentives and piecework systems do not allow these schemes to succeed in their aims.

In the United States it was noted (Ref. 35) that even with bonus payments productivity does not automatically increase without some concentrated effort. If a firm's policies are not appropriate, there may be no increase in productivity despite any 'big whip threats or unnecessary hirings or firings' (Ref. 35). It therefore appears that for economic incentives to be effective they must be incorporated into a framework with all the other existing situational variables.

In the/.....

In the United States studies of the behavioural aspects of construction have provided information on the motivation of manpower in construction (Refs. 22, 23, 24, 25 and 27). There is, however, very little documented information available on either the current status or results obtained, where a specific construction orientated programme was devised (Ref. 22).

Studies sponsored by the Construction Institute, Department of Civil Engineering, Stanford University, analyse findings on job satisfaction, job dissatisfaction and job productivity (Refs. 24, 25). The studies find that a productive job generally creates high job satisfaction, while one that falls behind schedule produces dissatisfaction at all levels.

The studies categorize factors which result in job satisfaction and dissatisfaction at various hierarchical levels of a construction project's organization and tabulate the means for increasing job satisfaction. This is because the studies are based on the findings of Frederick Herzberg's (Ref. 47)

'Motivation Hygiene Theory' which states that job satisfiers provide a means of increasing productivity. However, according to Porter and Lawler (Ref. 43) and the effort - performance model (Ref. 33), job satisfaction and performance are often unrelated. Job satisfaction will therefore not necessarily result in any increase in productivity on a construction site.

In order to seek some means of motivating construction workers in South Africa and thereby increase productivity, it was first necessary to collect empirical information on a particular aspect of the construction industry. This knowledge could then be integrated with existing theories to develop behavioural management techniques in construction contracting.



### CHAPTER 3 - THE EXPERIMENT

#### 3. THE MEASUREMENT OF ATTITUDES IN MAIN CONTRACTOR AND SUB-CONTRACTOR ORGANIZATIONS

The collection of empirical information on the behaviour of workers is important because this information must be combined with the theoretical generalizations in order to obtain a valid insight into any particular situation. In fact, previous attempts at applying behavioural techniques in the United States (Ref. 22) have been strongly criticized for their reliance on organizational studies of activities not related to construction (Ref. 26).

The information sought, in the behavioural analysis, was that related to the organizational and social variables affecting the performance of middle to lower management in construction contracting. This information was collected while maintaining certain independent parameters:

- i) The survey was conducted amongst contracting companies in the Western Cape during January - February 1977;
- ii) The survey was aimed at middle to lower management in the contracting hierarchy.

Other limitations were also borne in mind when analysing the various data sources.

The required behavioural information was sought by means of questionnaires distributed amongst main contractors and sub-contractors involved in building and construction.

However, more information was required than that gleaned from the questionnaires; this was obtained by various in-depth interviews with people, both within and associated with the industry. The system of interviews was also used to gauge the attitudes of top

management/.....

management in various building and construction companies.

The object of the questionnaire was to evaluate the attitudes of people to various statements in the questionnaire related to specific organizational and social factors. From the evaluation of people's attitudes, which reflect their opinions, it was possible to analyse certain existing characteristics of the construction contracting organizations in the Western Cape.

There are two types of commonly used attitude scales, the Thurstone and the Likert scales. The Likert scale is said to be equally or more reliable than the Thurstone scale and faster to use in measuring attitudes (Ref. 30). The Likert scale was consequently chosen in the compilation of the questionnaires for its simplicity in evaluation and for its ease of completion by the respondent.

Because of the large differences in organizational structure and objectives of main and sub-contractor organizations, it was decided to analyse the two groups separately. Different questionnaires were therefore drawn up and distributed independently, thus also affording the opportunity of investigating the relationship between the main contractor and his sub-contractors on a construction project.

### 3.1 THE QUESTIONNAIRE ON MAIN CONTRACTORS

The questionnaires were aimed at middle to lower management personnel working in construction, both on- and off-site. The organizations were medium to large sized companies in the Western Cape.

A great deal of difficulty was encountered in distributing the questionnaires for the purpose of the study. Various large construction companies were approached regarding the distribution of the questionnaires and in general the response of top management was very poor. A résumé of statements commonly encountered is:

i) 'I have/.....

- i) 'I have to shower my foremen with gifts and they still don't work.'
- ii) 'What is this behavioural stuff anyway?'
- iii) 'We have no intention of letting out any of our company secrets.'
- iv) 'Your study is of no use to us.'
- v) 'I must discipline my men, not coddle them.'

A few companies showed interest in a behavioural approach to increase productivity; these co-operated and were interested in the recommendations that would follow. However, they retained a healthy scepticism as to behavioural techniques of management.

The questionnaires were ultimately distributed amongst three separate construction organizations and a total of fifty questionnaires was returned. Twenty-three of these were from personnel working on-site, while the rest were from people working off-site or involved both on- and off-site. To obtain a better understanding of the difference between on- and off-site attitudes, the results from the two relevant groups were also analysed separately.

Though the questionnaires did not require any identification of the respondent, numerous individuals refused to complete the forms because of their fear that management would somehow identify them. One respondent gave alternate answers to questions indicating that the answer would vary depending on whether management would analyse the questionnaire or not.

Two systems were used to aid in the analysis of the results from the survey (Appendix A):

- i) The graphing of the degree of approval or disapproval of a question to the number of respondents;
- ii) Deriving/.....

- ii) Deriving positive or negative numerical values reflecting the strength of attitude to any particular question. The numerical values given were:

Strongly agree	+2
Agree	+1
Undecided	0
Disagree	-1
Strongly disagree	-2

During the analysis it was found that both methods were necessary to obtain a better understanding of the results. The graphs were more useful in depicting general results, while the numerical system was more useful in the more detailed breakdowns.

The questionnaire contained 24 statements related to the character and functioning of contracting organizations. These statements sought to stimulate the respondent to express his attitude to each particular statement (Appendix A).

Even though a vast amount of information on various behavioural factors would have been preferred, the questionnaire was kept as short and as simple as possible. This was because it was felt that the longer and more complicated the questionnaire, the less chance there would be of its being completed and returned.

The information sought can be divided into four main categories:

- i) A measure of the socio-organizational needs satisfied by existing contracting organizations;
- ii) The effectiveness of communication within the contracting organizations and the media of communication used;
- iii) The existence of the phenomenon of on-site detachment from off-site, with its various symptoms;
- iv) The personal/.....

- iv) The personal and organizational relationship between the main contractor and his sub-contractors.

The various statements were not always ordered according to their relevant categories. Certain statements also contribute to more than one category; however, the statements can generally be grouped according to the four main categories.

- i) The category on the satisfaction of socio-organizational needs includes statements Nos. 3, 4, 5, 6, 7 and 14 (Appendix A). The intention was to relate the attitudes expressed to the types of needs being satisfied in the existing organizations. From this one could ascertain the general character of the contracting organizations and consequently the management styles adopted.

Also associated with top management's attitudes and management style is the factor of utilization of capabilities. A measure was sought to gauge middle to lower management's feeling about whether they are utilized effectively or whether they could still contribute further to the organization.

- ii) The second category of statements, Nos. 1, 2, 7, 8, 9, 10 and 12 (Appendix A) sought to evaluate the effectiveness of the systems of communication within the organizations and the media of communication used. The statements used sought a measure of:

- a) The strength of the message received down the line, which was also achieved by using the breakdown of on-site to off-site attitudes;
- b) The effectiveness of downward and horizontal communication; the statement on downward communication (No. 10) also being relevant to upward communication;
- c) The types of communication media - verbal, written or both - used in the contracting organizations.

iii) The/.....

iii) The phenomenon of on-site detachment from off-site was generally analysed by the separate analysis of the attitudes relevant to each statement. A number of specific statements was also made in this regard (Nos. 11, 15, 16, 17, 18, 19 and 20).

It was generally sought to see if a significant difference in attitude existed between on-site and off-site personnel. Because of the physical distance between the head office and the various sites, information was sought to ascertain the effect of this additional filter on the communication process.

iv) The last category of questions in the questionnaire on main contractors was aimed at evaluating the personal and organizational relationship existing between the main contractor and his sub-contractors.

A number of statements, Nos. 21, 22, 23 and 24, from the survey on main contractor organizations was evaluated to determine attitudes towards sub-contractors. This information was treated in conjunction with the relevant section in the survey on sub-contractor organizations in order to obtain an overall picture of the relationship between main contractor and sub-contractors on the construction project.

It was felt that the four main categories investigated in the questionnaires, and the various interviews conducted with selected individuals in top management and middle to lower management, gave an initial insight into construction organizations. However, to complete the picture as far as a construction project is concerned, a certain amount of knowledge was also sought about sub-contractor organizations.

### 3.2 THE QUESTIONNAIRE ON SUB-CONTRACTORS

The survey on sub-contractor attitudes was conducted in a similar way to that adopted with main contractor organizations.

The questionnaires/.....

The questionnaires were distributed amongst personnel in middle to lower management levels in sub-contractor organizations varying in size from small to large.

Those questioned were in contracting organizations mostly involved in building operations and worked both on- and off-site. Due to the small number of respondents who worked only on-site, the analysis did not investigate the on- and off-site conditions separately.

Problems were again encountered in getting the questionnaires distributed and returned. In comparison with the main contractor survey, the problem was more in the return than in the distribution of the questionnaires. It appeared as if the filling in of the questionnaire and its return were being done as a personal favour to the researcher.

Thirty-two completed questionnaires were returned, these coming from nine independent sub-contractor organizations. The organizations were involved in the fields of:

- i) Air conditioning
- ii) Floor coverings
- iii) Shopfitting
- iv) Electrical
- v) Sprinklers
- vi) Ducting and sheetmetalwork
- vii) Plumbing
- viii) Ceilings
- ix) Partitions

The above are a representative sample of sub-contractor organizations involved in a medium-sized building project.

To complement the survey which used questionnaires, a number of in-depth interpersonal interviews were conducted with

individual/.....

individual sub-contractors in the fields described above. These gave an insight into opinions which were not expressed in the questionnaires.

Because of the similarity in method used in the questionnaire on sub-contractors, it was analysed in the same way as the questionnaire on main contractors. The results from the Likert scale were interpreted by means of graphs and the allocation of numerical weightings to the various answers received.

The questionnaire contained 24 statements related to the character and functioning of sub-contractor organizations. These statements pertained to three main behavioural categories:

- i) The socio-organizational needs, both satisfied and existing in the organizations;
- ii) The functioning of the organizations internally and their on-site performance;
- iii) The personal and organizational relationship of the sub-contractor to the construction project and the main contractor.

The various statements were not always ordered according to their relevant categories. Certain statements contribute to more than one category, but a general grouping was formulated.

- i) The category of statements on socio-organizational factors was similar to those used for main contractor organizations, and were Nos. 1, 2, 7, 12, 13, 14, 15 and 22.

The organization and structure of sub-contractor companies varies from that of main contractor organizations and it was the intention to investigate whether any differences could be ascertained between the two types of organization. An insight into the needs that are satisfied provides useful

information/.....



information on the motivation of those questioned.

ii) The second category of statements sought information on two factors, the one being the communication within the organization, by means of questions Nos. 1, 8 and 9, and the other factor was on-site performance of sub-contractor organizations, which was analysed by means of questions Nos. 11, 17, 20 and 21 (Appendix B).

In the interviews conducted with main contractors certain on-site inefficiencies of sub-contractor organizations were referred to repeatedly. It was sought to determine, by means of the above questions, whether middle to lower management staff were aware of these inadequacies in their organizations.

iii) Information regarding the main contractor to sub-contractor relationship on the construction project was sought under two aspects:

- a) The attitudes relating to the project's formal organization and the direct stimuli of the main contractor;
- b) The effects of personal functions and indirect stimuli of the main contractor on the sub-contractor organization.

The statements which related to the above behavioural aspects were Nos. 3, 4, 6, 10, 16, 18, 19, 21, 22, 23 and 24 (Appendix B). The relevant questions in the questionnaire on main contractors (Appendix A) were also incorporated in the analysis of this particular section.

It was hoped that the information collected on the above three behavioural categories would provide means for improving the overall efficiency of sub-contractors on construction projects. This could be achieved by an investigation of the efficiency of the sub-contractor within his own organization and in his association with the construction project.

## CHAPTER 4 - RESULTS

### 4. THE RESULTS OF ATTITUDE QUESTIONNAIRES FROM CONTRACTORS IN CONSTRUCTION ORGANIZATIONS

The attitudes expressed in the two questionnaires were used to formulate certain general behavioural trends about construction contracting. However, all the results and conclusions have to be considered in the light of their limitations. These are that the information obtained was from people:

- i) Employed in construction in the Western Cape during the period January - February 1977;
- ii) In the middle to lower management level;
- iii) Working both on- and off-site;
- iv) Employed in medium to large sized construction companies or by one of the diverse types of building orientated sub-contractor organizations.

In the analysis of the results use was made of the same socio-organizational groups of statements which were used to compile the questionnaires. The same division of main contractor to sub-contractor organizations was also retained.

#### 4.1 MAIN CONTRACTOR COMPANIES IN CONSTRUCTION

Behaviouralists (Refs. 9, 41, 42) state that the worker tries to satisfy certain monetary needs through his job and many people feel that money is the prime reason why men work. There are, however, other OUTSTANDING NEEDS the fulfillment of which also stimulates men to work.

The level of fulfillment of various factors stimulating people to work gives an indication of top management's attitudes towards their employees. This attitude is reflected in the character of the organization and the role

performance/.....

performance perceived by those within the company.

Analysis of the results obtained (Appendix A), showed that people are stimulated to work harder by factors other than just money. In fact, the respondents rated the factors likely to increase their work output over the long term (Figs. 3m, 4m, 5m, 6m) in the following order of importance:

Promotion or recognition  
Superiors' greater interest in work done  
Money  
Fear of losing job

The above rank ordering brings to light two other facts:

- i) The importance given by the respondents to the factors of promotion, recognition and more interest being shown in the worker;
- ii) The low rating given to 'the fear of losing one's job' as a stimulant to increased production.

The above results seem to indicate management's belief in 'Economic Man'. This is because of the noticeable lack of satisfaction derived by middle management from non-monetary stimulants. Complementing the apparent symptom, which Douglas MacGregor describes as the Theory X management approach (Ref. 2), is the fact that people feel that they are under-utilized and kept in the dark as to the happenings in the firm.

In the analysis of the questionnaires a very strong response (Fig. 14m) indicated that those questioned felt they were not given enough responsibility in their work. There was also a strong indication (Fig. 7m) that the respondents felt uninformed about happenings within their organization.

The empiric/.....

The empiric results of this section of the survey were symptomatic of top management adopting a scientific management approach. This approach, associated with D. MacGregor's Theory X assumptions on human behaviour can result in an under-utilization of people's abilities.

Some of the people interviewed in top management openly admitted to being believers in the Theory X management approach, but they were convinced that a large part of their organization's inefficiencies were due to a breakdown in communication within their companies. Theoretically this is because a non-adaptive, bureaucratic-type organization is more dependent on its lines of communication as a result of its reliance on formally instituted co-ordinating systems.

The information collected about the COMMUNICATION PROCESS in construction contracting companies was analysed in terms of the downward and horizontal communication processes and the various media used.

Two aspects of downward communication were considered:

- i) its strictly organizational function;
- ii) its social function in stimulating a feeling of participation in the company.

Formal downward communication characteristics were found to appear in the results of the organizations investigated (Figs. 1m, 2m, 10m), though the communication process further down the line failed largely because of an apparent lack of feedback. This symptom was more obvious in an analysis differentiating between on-site and off-site data (Fig. 10m). While a negligible number of people off-site felt that 'instructions from above were often irrelevant to existing conditions', this figure rose to 45% for on-site personnel.

Fig. 14m/.....

Fig. 14m

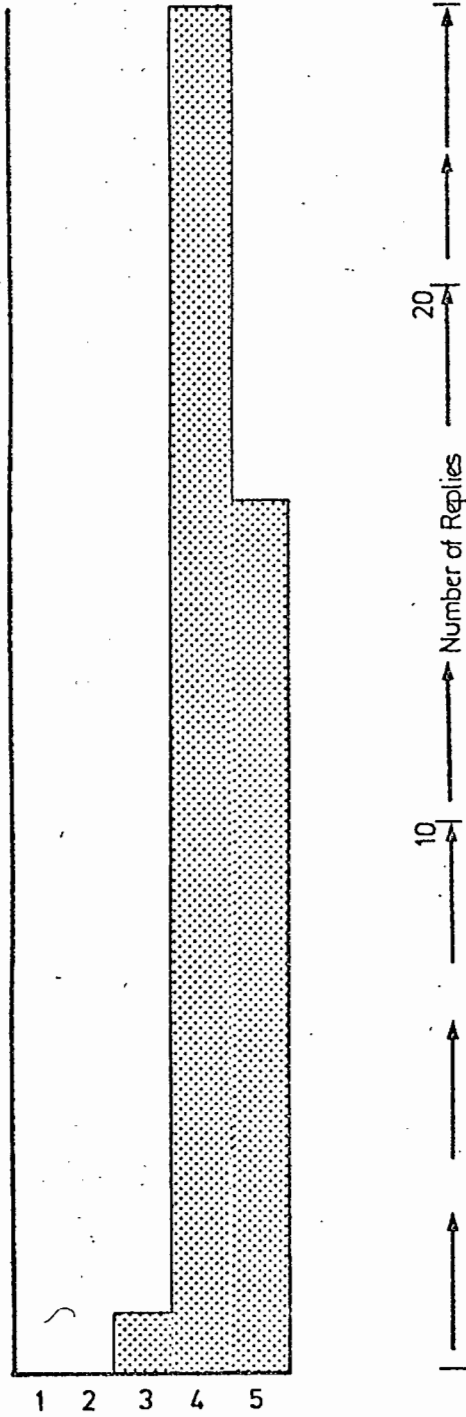
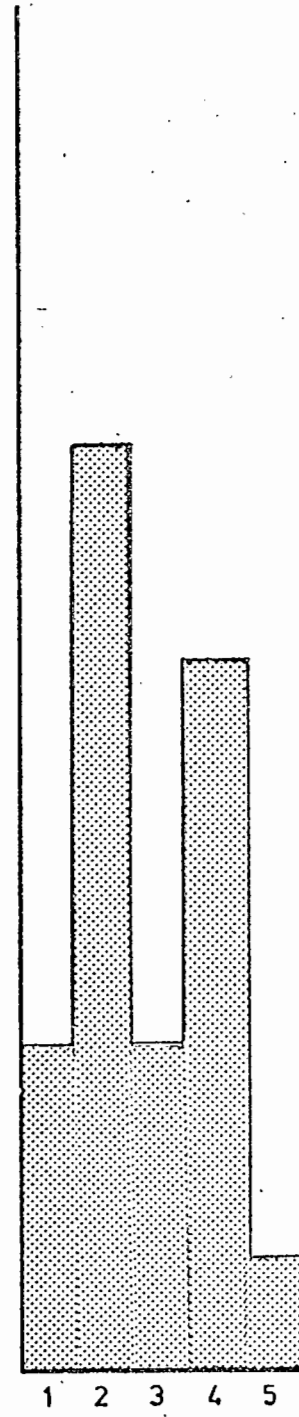


Fig. 7m



The RESPONSIBILITY presently given  
to me is TOO GREAT.

I feel KEPT IN THE DARK about  
happenings in the Firm.

Code.

- 1 = Strongly Agree  
2 = Agree  
3 = Undecided  
4 = Disagree



One of the main barriers to communication is that of incorrect perceptions of the receiver. In contracting organizations this barrier is compounded by additional filters:

- i) Resistance to change;
- ii) The physical distance between the sites and the Head Office.

Resistance to change is commonly quoted as a factor retarding the adoption of new techniques in construction (Refs. 3, 15). It is also a barrier to effective communication since it will result in the receiver avoiding, rejecting, or distorting the message to suit himself.

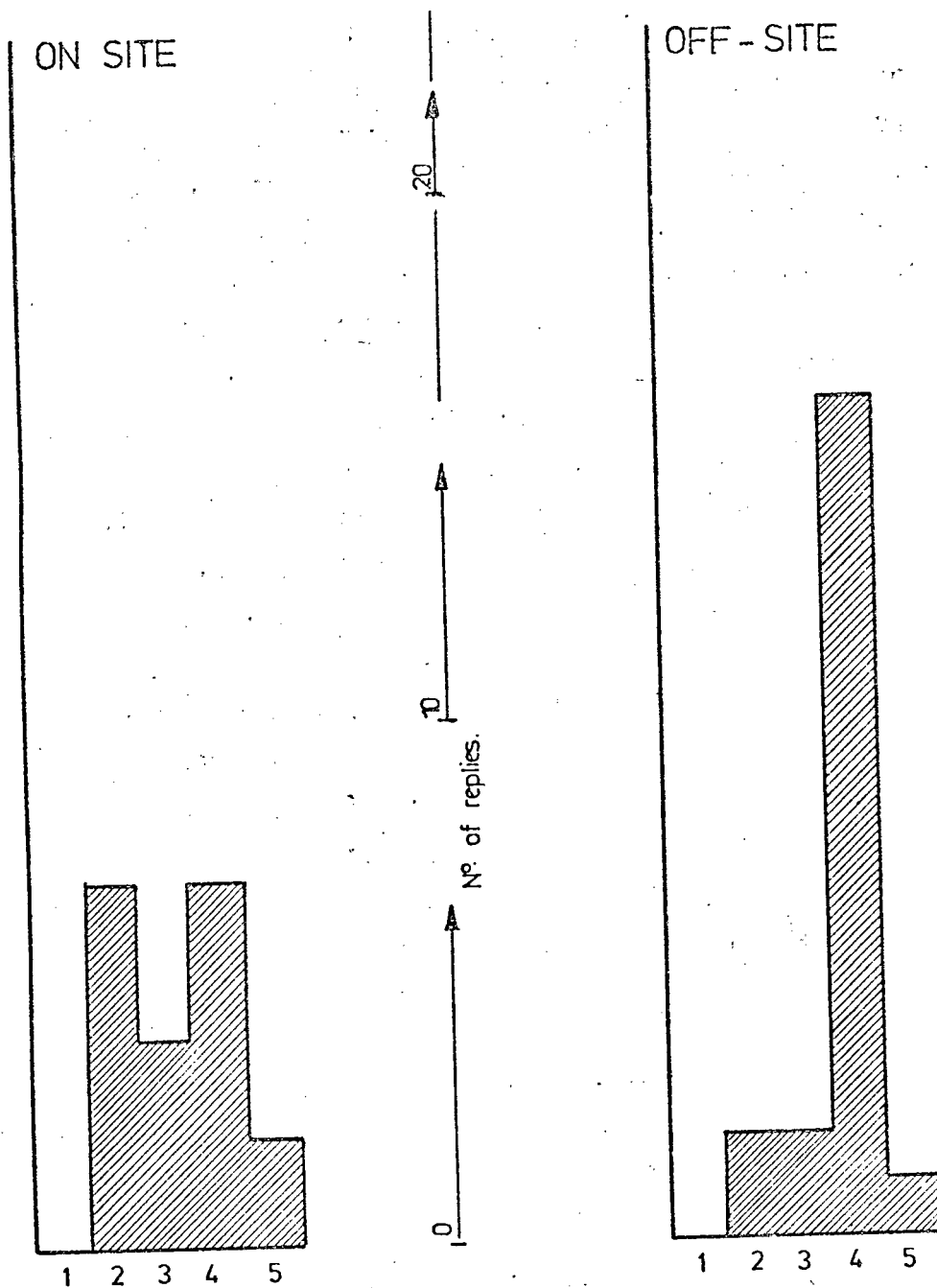
The physical detachment of site and head office is apparent in the breakdown of the communication process (Fig. 10m) between the two. The reason for this breakdown in communication is also due to the feeling of psychological isolation experienced by site personnel.

The social or participative side of the communication process was found to be weak in the contracting organizations. In fact the general feeling amongst the respondents was that they were 'kept in the dark about happenings in the firm' (Fig. 7m). This feeling is symptomatic of a bureaucratic organization.

The results of Figure 8m show a strong informal horizontal communication process, which is due to the function of the grapevine existing in the organizations. The existence and strength of the grapevine is accentuated in formally structured organizations which do not allow for upward or horizontal communication in their make up.

It is therefore apparent that formal downward communication must be complemented by a feedback loop (Fig. 7). Where this feedback loop does not exist, as in the case of many sites,

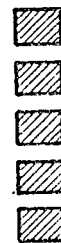
Fig. 10m



INSTRUCTIONS I received FROM ABOVE  
are OFTEN IRRELEVANT to existing  
conditions.

Code

- |   |   |                   |
|---|---|-------------------|
| 1 | = | Strongly Agree    |
| 2 | = | Agree             |
| 3 | = | Undecided.        |
| 4 | = | Disagree          |
| 5 | = | Strongly Disagree |



downward/.....

downward communication is meaningless. Complementary to the sender, the receiver and the feedback loop, the other important factor in the communication process is the chosen medium. In construction the two main types of communication media used are oral and written. The particular situation normally dictates which of the two, or what mix of the two, is the OPTIMUM COMMUNICATION MEDIUM.

Written communication is a more formal medium which has the advantage of protection against continuous reinterpretation, while a disadvantage is its lack of flexibility when there is need for continuous revision. It also does not guarantee any quick or direct feedback.

Oral communication is a flexible medium, though its limitations are found when large groups are concerned and in the communication of lengthy or complicated information. Its main advantages are that interpersonal oral communication facilitates all steps of the communication process and it also develops sensitivity regarding the feelings of both the sender and the receiver of the message.

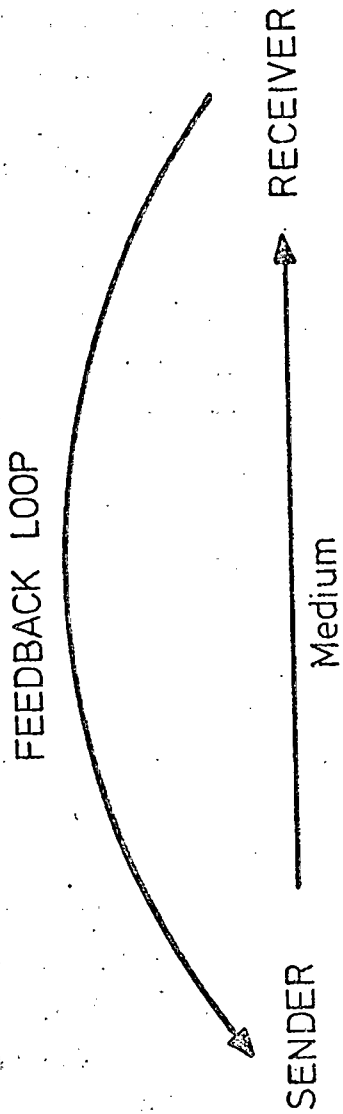
Analysis of the means of communication in construction contracting organizations showed the following results:

- i) Management communicates with sites mainly by written memoranda (Fig. 12m), while at head office there is a greater tendency to use oral communication;
- ii) Most people employed on site prefer verbal communication, while people at head office are more indifferent to the medium used (Fig. 9m).

The results showed that the construction sites, while preferring verbal instructions from management, generally receive them



Fig. 7



Schematic of Communication Process

through/.....

through memoranda. This preference for verbal instructions by site staff may be due to the fact that psychologically they feel detached from head office, or it may derive from the fact that site staff are generally less academically advanced than those off-site. They therefore need, and prefer, the more efficient medium of verbal interpersonal communication.

The analysis of the existant communication systems in contracting organizations showed a general lack of upward communication which stimulates participation in the organization, and a near breakdown in the communication process between head office and the sites. This phenomenon of the social and organizational detachment of sites from head office is a problem which appeared to require further analysis.

#### 4.1.1 On-Site Detachment from Off-Site

The detachment that exists between the workforce on the line and those less directly involved is a common problem in any production process. It is felt that the origins of this detachment are partly due to departmentalization.

The classical management theorists stated that departments fitting within a pyramid-shaped organizational hierarchy were necessary to gain the advantages of specialization. However the pyramid-type organization does not allow for continuous recycling of decisions.

In construction contracting the unforeseen and complex problems, together with the great financial risk involved, require a continuous recycling of decisions. Since the site-to-head-office link was often found to be the weakest communication link, the sites tended towards isolationism. This natural tendency towards isolationism, due to poor communication and the traditional departmentalization which resulted from specialization, contributed to the phenomenon of on-site detachment from off-site.

In analysing/.....

In analysing the information collected in the survey on main contractor organizations, two aspects of on-site to off-site detachment were investigated:

- i) Difference in attitudes;
- ii) The communication gap.

i) Personnel on site prefer site work to off-site work (Fig. 20m), and it is also felt by both groups that staff on site generally show more enthusiasm for their work (Fig. 18m). The above must be viewed while bearing in mind that environmental conditions on site compare very poorly with those found in an office or factory situation. Why then the enthusiasm shown and preference to work on site?

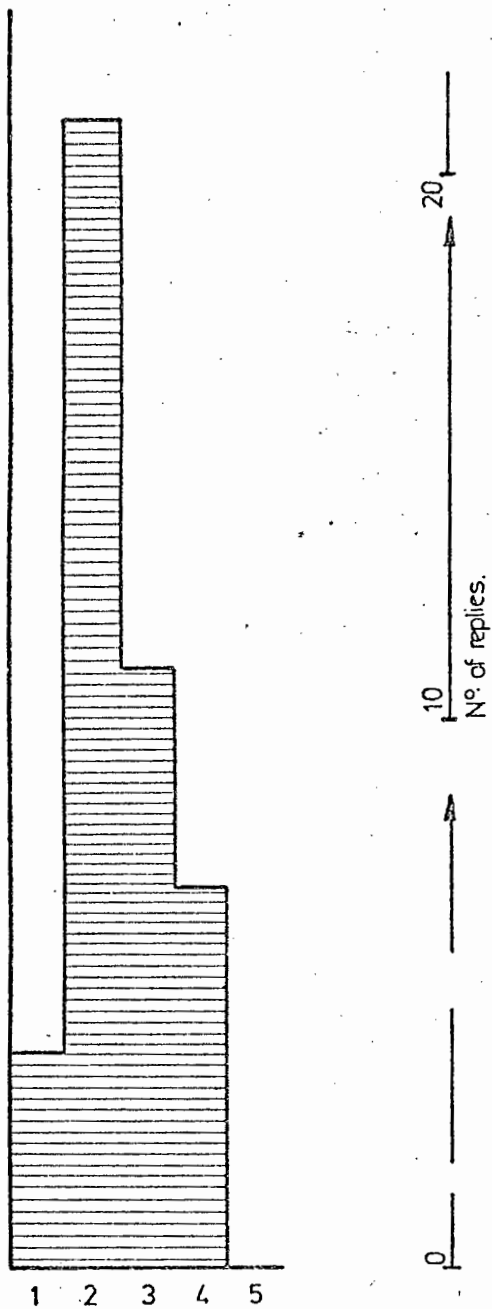
Site personnel have the intrinsic motivation of the task itself. The very fact of physical accomplishment and creation acts as a stimulant. In the on-site situation site personnel belong to the same primary group, a group to which they desire to belong and for which they have pride of membership.

It is interesting to note that staff on site feel that management shows an interest in them and their site problems and that management can be made aware of their problems. However, at the same time they feel that the instructions they receive on site are often irrelevant to existing conditions (Figs. 10m, 19m). On-site personnel thus appear to be a more motivated and enthusiastic group; however, they also feel that management is not quite 'in tune' with site situations.

ii) The main problem of co-ordination with people both on- and off-site is that of communication. One has all the traditional communication obstacles as well as that of spatial segregation.

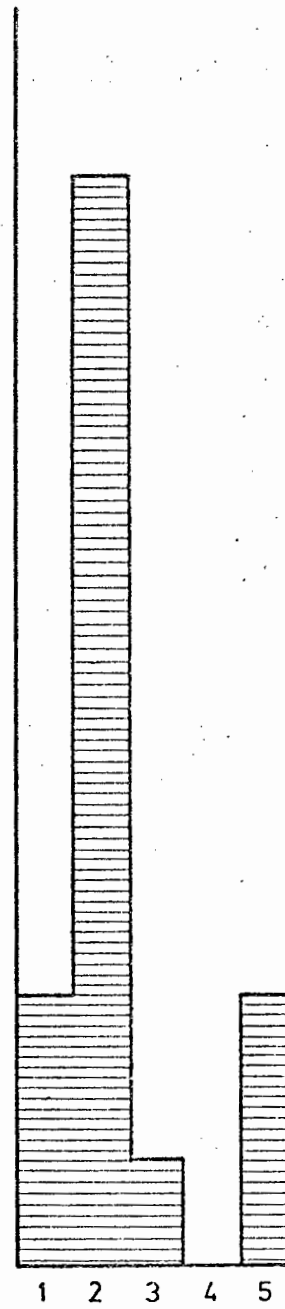
Fig. 18m/.....

Fig 18m.



STAFF ON SITE generally SHOW more ENTHUSIASM for their work.

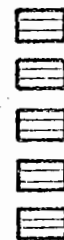
Fig 19m.



MANAGEMENT shows an INTEREST in ME and PROBLEMS on site.

Code

- 1 = Strongly Agree
- 2 = Agree
- 3 = Undecided
- 4 = Disagree
- 5 = Strongly Disagree



Spatial/.....

Spatial segregation not only acts as a filter to communication, but it also restricts the communication medium and increases the time lapse before feedback (Fig. 7).

Decisions taken on site often need to be recycled and thus a continuous flow of information is required. But it was found that management and off-site personnel tend to communicate with those on-site by means of memoranda (Fig. 12m) and hence upward communication is not fostered. This diminishes the sensitivity between on and off-site personnel. The resulting lack of sensitivity may result in on-site staff feeling that management often gives instructions irrelevant to existing conditions (Fig. 10m).

Construction sites consequently tend to become autonomous. Their objectives may not necessarily reflect those of top management, nor do they identify themselves with supporting departments which are not situated on site. This was apparent because, while on-site supervisory staff believed they were strongly aware of their firm's aims (Fig. 1m), this fact conflicted with the belief of those off-site, who were not as sure of their firm's objectives, nor of how they came to know of them (Fig. 2m).

The spatial division of staff allocated to a particular project thus introduces a communication gap. To obtain maximum utilization of the staff, more attention must be given to communication between those on- and off-site.

It is therefore apparent from the results of the survey on main contractor companies that they have rigidly structured organizations which are run according to the principles of scientific management. Further analysis of the results showed the communication process in these organizations to be lacking the feedback loop.

The communication/.....

The communication gap between the on-site and off-site sections of the organizations has contributed to the phenomenon of on-site detachment from off-site. Behavioural theory states that a non-adaptive organization should have problems when a continuous recycling process is required, and this fact was borne out by the results.

However, to gain an overall insight into construction contracting, further analysis of sub-contractors and their relationship to the project is required. Most of this information was obtained from the survey on sub-contractor organizations (Appendix B).

#### 4.2 SUB-CONTRACTOR COMPANIES IN CONSTRUCTION

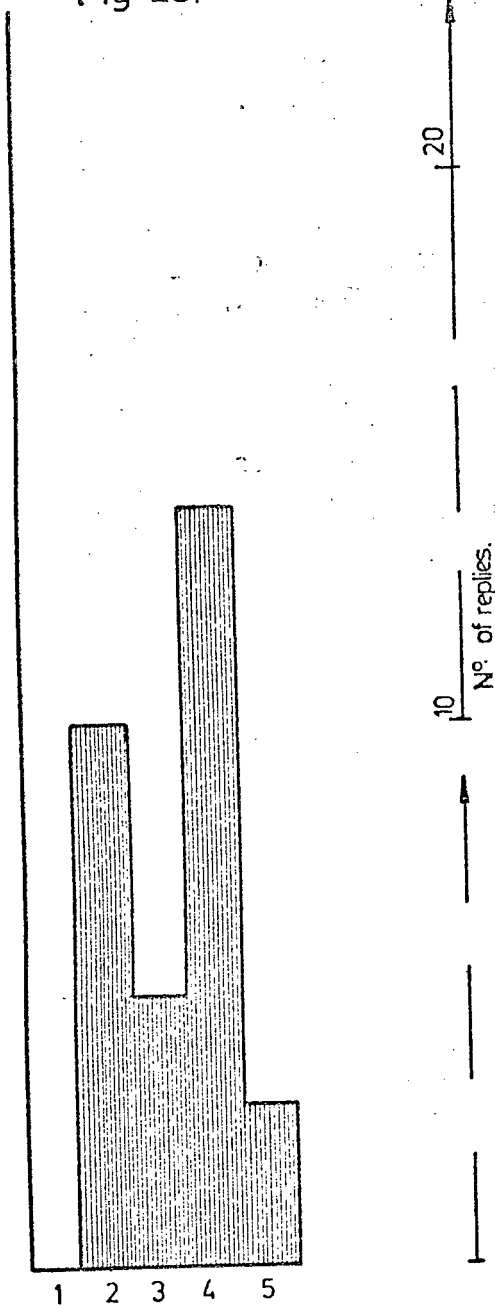
The data from the survey on sub-contractors was analysed in various groups, though, as in the previous survey, the questions in one group could have been relevant to the others. The first section of the analysis centred on the stimuli motivating people in the sub-contractor companies to work. This analysis was followed by an investigation of the functions within their companies and their on-site performance. Finally, the personal and organizational relationship of the sub-contractor relative to the construction project and the main contractor was investigated.

It was felt necessary to study the OUTSTANDING NEEDS of those employed in sub-contractor organizations, in the same manner as main contractor organizations, in order to evaluate the difference, if any, between the two. A change in response was expected because of the theoretical difference in the two organizational structures.

In analysing the results it was found that the majority of those employed in sub-contractor companies are generally satisfied working as sub-contractors. Actually, 66% of those questioned would not leave sub-contracting even if they had the opportunity (Fig. 22s).

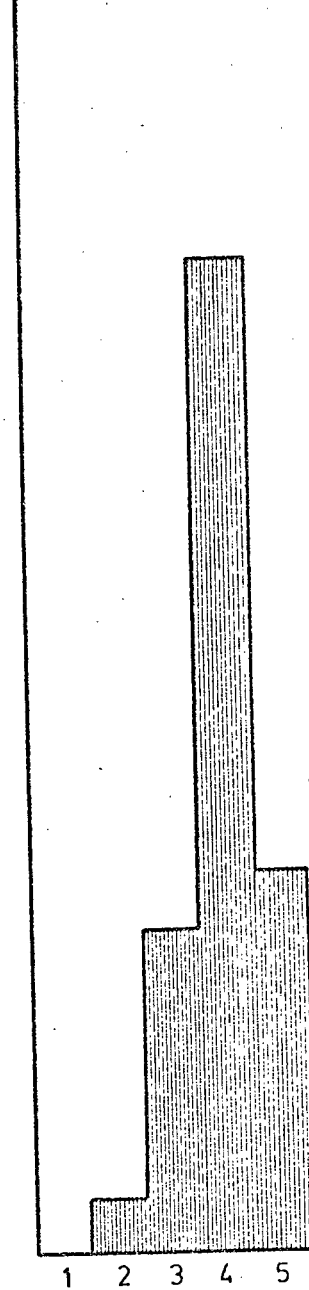
Fig.2s/.....

Fig 2s.



If required I COULD DO a lot  
MORE WORK than EXPECTED of me.

Fig 7s.



I feel that I am GIVEN TOO  
MUCH RESPONSIBILITY in  
my work.

Code

- 1 = Strongly Agree
- 2 = Agree
- 3 = Undecided
- 4 = Disagree
- 5 = Strongly Disagree



Again/.....

Again, as in main contractor organizations, the respondents strongly felt that they are 'not given too much responsibility in their work' (Fig. 7s). However this attitude was associated with two other noticeable facts not found in the previous survey:

- a) A large group of respondents did not feel that they could do a great deal more work than that expected of them (Fig. 2s);
- b) The respondents did not wish their supervisors to take more interest in them and their work (Ranking of Figs. 12s, 13s, 14s, 15s).

a) The first phenomenon, that a large group of respondents felt they could not do a great deal more work than that expected of them, was confirmed in the answers to the question of whether one would work harder over a longer period of time for:

More money

Promotion or recognition

The fear of losing one's job

More interest being taken in their  
work by their superior

In the answers it was also apparent that an equally large group would not work harder no matter what the incentive.

The above phenomena may be seen as the result of two factors:

- i) The individual perceives that his role does not give him scope to work harder than he is presently doing;
- ii) The fact that some individuals do not have any desire in them to work harder and thus the stimuli would have no reaction.





If one/.....

If one considers the first factor it would appear that job design is at fault. This diagnosis was supported by the general ranking given to the various work stimuli, taking as a constant the group of people that was not stimulated. A listing by importance of the needs most requiring to be stimulated was:-

Promotion or recognition

Money

Superior taking more interest in the  
individual in his work

Fear of losing one's job

The importance given to promotion or recognition and desire for autonomy must be viewed together with the fact that most of the respondents felt that they were not given too much responsibility in their work.

It appeared that middle to lower management levels in sub-contractor organizations feel that they require more responsibility and autonomy in the work they would like to perform. Though presently fully utilized in the role they perceive as theirs, they seek a greater outlet and scope for their abilities. The onus therefore falls on the leader of the sub-contractor group.

The leader of a sub-contractor group has certain advantages and disadvantages peculiar to the character of sub-contractor organizations. The main advantage is that of direct stimulus and response because of the extensive use of interpersonal communication. He has, however, the disadvantage that it is difficult for him to use the organizational structure as a means to promotion, recognition or the granting of independence to the individuals in his group, as he lacks the ability available to one in a large organization.

The other/.....

The other sectors investigated in sub-contractor organizations were the communication process and their on-site performance. The very character of sub-contractor organizations, which consist of small groups of people, aids the COMMUNICATION PROCESS.

In the analysis it was found that there was a strong awareness of the company's objectives, coupled with the realization that most instructions from above were considered to be meaningful (Figs. 1s, 9s).

Downward communication was complemented by a strong horizontal communication process (Fig. 8s), but it was not possible to measure the continuation of the communication process to the sites. The measure was impossible due to the low proportion of total time spent by middle to lower management on site, but a measure of the attitudes concerning ON-SITE PERFORMANCE was undertaken.

Certain construction projects do not necessitate large sub-contractor work crews or long periods on site, and site supervision is not commonly found to remain permanently on site. In contrast, the main contractor has supervisory staff on site constantly.

The vast majority of supervisory staff amongst main contractors on site state that sub-contractors work less than their own men (Fig. 22m). The above fact is complemented by the following two attitudes ascertained by supervisors amongst sub-contractors:-

Men on site often work as much as an hour less than the allocated time (Fig. 23s);

Overtime without an increase in supervision decreases productivity greatly (Fig. 17s).

In addition, fifty percent of sub-contractors felt that men on site lose a significant amount of time because of the lack of materials, tools or information.

There/.....

There is a general awareness that sub-contractor performance on site is not what it should be, compared to a more efficient off-site operation. It is therefore important to seek means of integrating the sub-contractor effectively into the main project and also improve his production on site.

#### 4.3 ATTITUDES OF MAIN AND SUB-CONTRACTORS ON THE CONSTRUCTION PROJECT

The integration of sub-contractors into a project is important to the overall productivity on the site and therefore the attitudes existing between main contractors and sub-contractors are important variables. Project co-ordination and control are largely the responsibility of the main contractor who effects the efficiency of the project by:

- i) His attitudes relating to the formal organization of the project and consequently his direct stimulus of the sub-contractor;
- ii) His attitudes relating to his personal and social function on the project, which provides an indirect stimulus to the sub-contractor.

Certain large national construction companies have noticeable policies towards their sub-contractors. However, more often than not, main contractor to sub-contractor relations will differ according to the approach of supervisors on any particular project.

From the analysis of sub-contractors in the Western Cape it was apparent that they enjoy being associated with certain construction projects more than with others (Fig. 3s). This attitude is influenced by the sub-contractor's awareness that the main contractor's management style affects his performance on the project (Fig. 16s). He therefore prefers projects where he is able to perform best.

From the/.....

From the results of the attitude survey it was apparent that sub-contractors 'prefer projects where control by the main contractor is strict' (Fig. 4s). This attitude was confirmed by the respondents' prevalent attitude that they did not 'prefer projects where [they] can work where and when [they] want' (Fig. 6s).

It is therefore apparent that the sub-contractor, recognizing the effect of efficient project management, prefers strict control on site. However, the main point of conflict between the main contractor and sub-contractor was found to be that of the sub-contractor keeping to schedule (Fig. 24s). The attitudes of sub-contractors to the management of construction projects provide an indication of the problems associated with the complaint that they are always behind schedule. It was generally felt by sub-contractors that the organization of projects is poor and they feel that their own organizations are more efficient than those of the main contractor. In addition to this, only 37% of sub-contractors feel they are given adequate warning of when they are required on site (Fig. 10s).

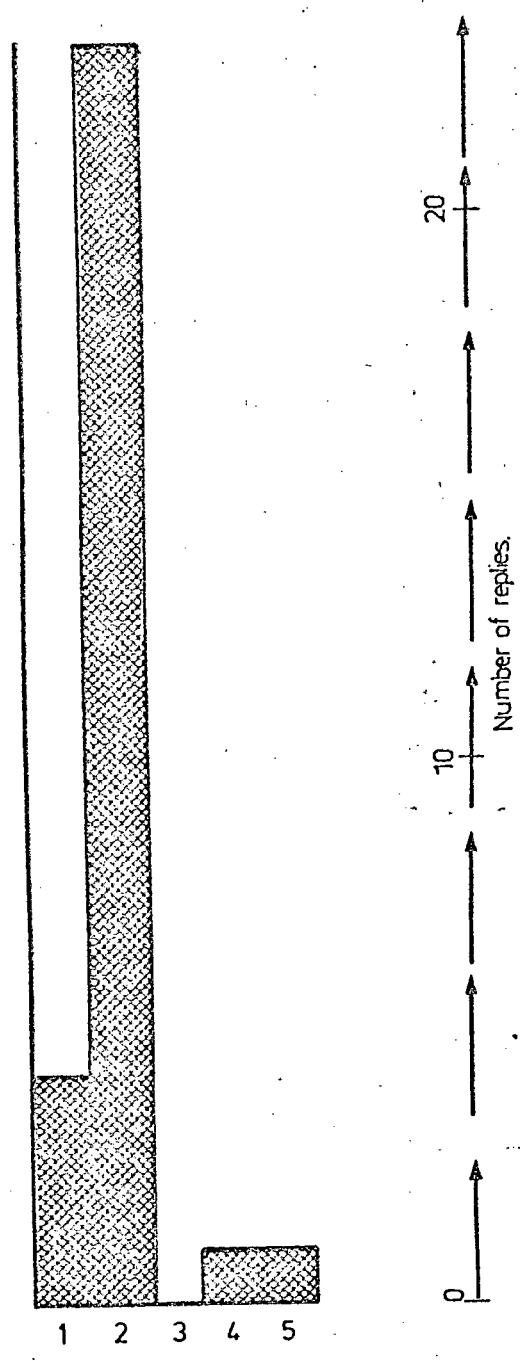
The problem of being called onto site late is further compounded by the fact that 55% of sub-contractors felt that they are brought on site too early to have continuity of work for their men (Fig. 19s). It therefore appears that the main contractors do not effectively programme their work.

Main contracting organizations need to concentrate on developing and using an effective master scheduling system. The purpose of this system would be to enable a strict sub-contractor time and resource control and to adequately pre-warn the sub-contractors of the particular requirements of the projects.

Apart from the main contractor's function as a direct organizer and co-ordinator, he also affects overall productivity on site

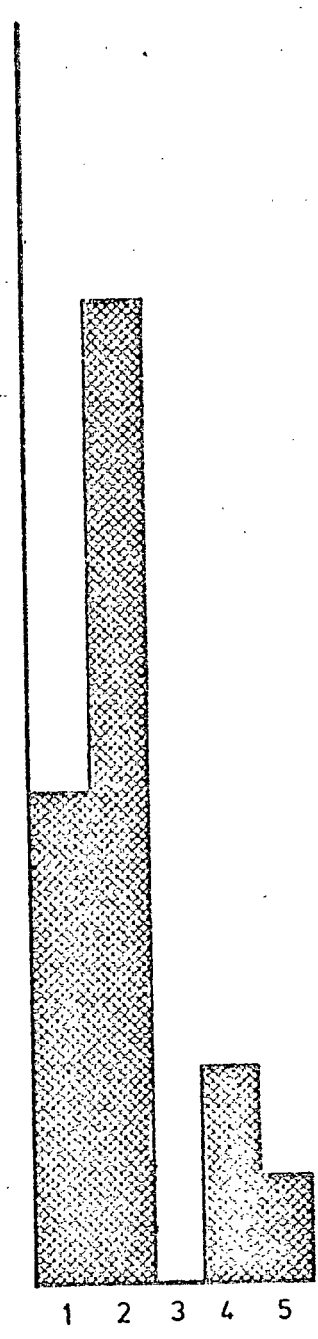
Fig. 3s/.....

Fig.3S








I ENJOY being ASSOCIATED with  
CERTAIN CONSTRUCTION PROJECTS  
more than with others.

Fig.4S

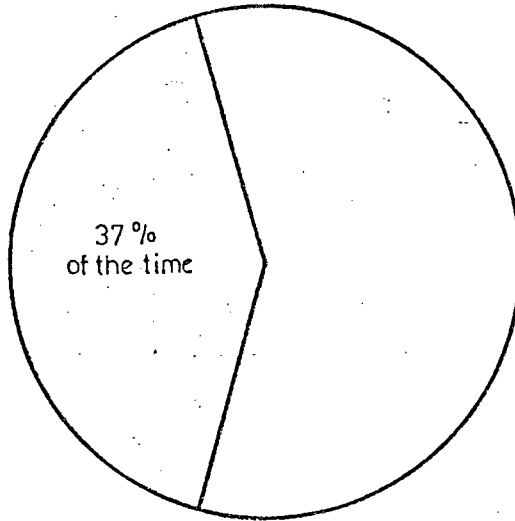


I PREFER PROJECTS where CONTROL  
by the main contractor is STRICT

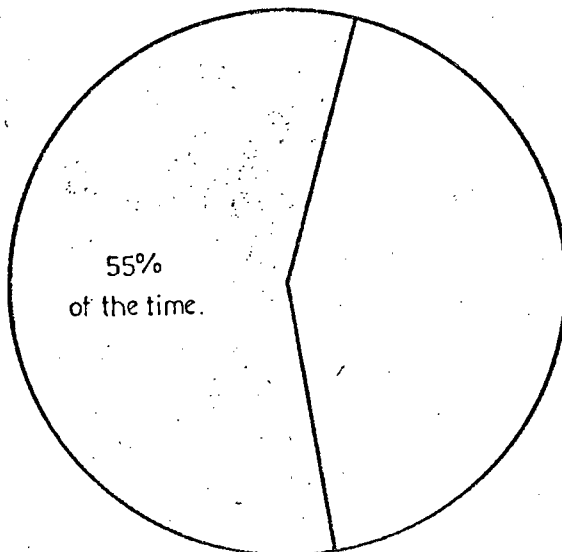
Code.

- |    |                   |   |
|----|-------------------|---|
| 1= | Strongly agree    |  |
| 2= | Agree             |  |
| 3= | Undecided         |  |
| 4= | Disagree          |  |
| 5= | Strongly disagree |  |

- 10 s The MAIN CONTRACTOR gives me ADEQUATE WARNING of when I'm NEEDED on site.



19. S The main contractor often CALLS me ON SITE TOO EARLY



indirectly/.....

indirectly by his social participation with those involved on the contract. Sub-contractors' productivity on site is greatly affected by the main contractor's attitudes and behaviour, and the main contractor also feels a strong obligation to check the quality of work of the sub-contractor (Fig. 24m). However he normally only deals with the sub-contractor at supervisory level and consequently there is no formal control over sub-contractors' workmen on site.

It was found that sub-contractors would like the main contractor to take more interest in their men on site (Fig. 18s). Though this would reduce the degree of independence of the workmen on site, it would alleviate the present sub-contractors' supervisory load.

The low productivity of sub-contractor workmen on site is a cardinal point in overall productivity in construction contracting. The use of direct main contractor supervision in a limited capacity would constitute a means of trying to increase production. However, the factors of resistance to change and relevant monetary compensation are two problems which would arise from this scheme.

The information that was collected on the social and organizational aspects of main contractors, sub-contractors and their involvement on construction projects, is only of use if it is applied. The use of the information lies in:

- i) Making people aware of the behavioural problems found to exist in the industry;
- ii) Utilizing the knowledge in the formal structuring of construction organizations;
- iii) Its use in the development and application of formal and informal incentives to increase productivity in the construction industry.



## CHAPTER 5 - DISCUSSION

### 5. MOTIVATION OF PERSONNEL ON CONSTRUCTION PROJECTS

The information collected in the behavioural surveys on main contractor and sub-contractor organizations can be integrated with generalized theories to provide an information base which is necessary to stimulate functional behaviour in construction. This information can be utilized in the structuring of construction companies or projects and it may also be taken into consideration in the choice of supervisory styles or the development of formal incentive schemes.

The use of formal INCENTIVES in a company is aimed at stimulating the worker to achieve specific organizational goals. An incentive scheme is normally thought of as some form of economic stimulant; however, both the effort-performance model and the results of our behavioural study showed money to be only 'part of the story'. It is therefore necessary to investigate the characteristics of various incentive schemes and to seek appropriate means for motivating workers in construction contracting.

For economic incentives to be effective they must be incorporated into the broader framework of a behavioural model which takes into consideration the influence of non-monetary variables. Unfortunately very little documented evidence is available on the current state, or on the results obtained where a specific construction-orientated behavioural incentive programme was devised (Ref. 22).

Studies sponsored by the Construction Institute, Department of Civil Engineering, Stanford University, analysed findings on job satisfaction, job dissatisfaction and job productivity (Refs. 24, 25). These studies found that a productive job generally creates high job satisfaction, while one that falls behind schedule produces dissatisfaction at all levels. The study also categorized those factors which result in job satisfaction at various hierarchical levels of a construction project's organization.

It was then/.....

It was then assumed that some of the job satisfiers could be used as positive motivators to increase job productivity, as postulated in Frederick Herzberg's findings (Ref. 47) on the 'Motivation Hygiene Theory'. However the relationship of increased satisfaction to increased performance has been questioned by other behaviouralists (Refs. 32, 33, 43). It is therefore evident that more construction-orientated analyses of behavioural techniques are required.

Even though there are numerous difficulties involved, it is necessary to adopt the behavioural approach in formulating new schemes to motivate workers in construction in South Africa. The need for formal and informal incentive schemes is highlighted by the following facts:-

- i) Construction contracting is labour intensive. At a speech given at the Graduate School of Business, University of Cape Town, Mr D.E. Baker, the Managing Director of a large national construction company, is quoted as saying that two-thirds of the money spent on an average multi-storeyed building went into labour costs;
- ii) The overall productivity in contracting (see Chapter 1) has not shown any marked improvement over the past years, having increased by a factor of 32% in the period 1960 - 1972;
- iii) Absenteeism of labour on Mondays has been indicated as a major problem in the building industry. Absenteeism was found to range between 5 and 30 percent (Ref. 4);
- iv) Labour turnover of skilled staff has been quoted by large contractors to reach rates as high as 500 percent (Ref. 4);
- v) The general standard of skilled building labour has deteriorated alarmingly. This situation is not only peculiar to South Africa (Ref. 25).

One of the/.....

One of the factors often quoted in the attempt to counter the introduction of incentive schemes is that PRODUCTIVITY is a FUNCTION OF THE LABOUR MARKET, and that the keener the competition of the labour market, the lower the productivity of the labour (Ref. 3). This assertion is only partly true. In the analysis of mid- to lower management in the Western Cape (Appendix A and Appendix B), the fear of losing one's job was not found to be a motivator to increased production. The factors which were motivators were all inter-organizational and these motivators are divorced from the fear of losing one's job. In addition, unskilled labour for construction projects is often brought on contract from foreign countries or African homelands and consequently there is no great influence on the production of these labourers by the labour market.

There often is, however, an increase in productivity during a period of intense competition from the labour market and this generally occurs during a downswing in the fluctuations of the economic state of the construction industry. On questioning numerous site personnel amongst main and sub-contractors during a depression period in the Western Cape (June 1977), increased productivity was attributed to:-

- i) Increased supervision and control of the existing contracts because of reduced workload;
- ii) The general feeling that times are bad and one must make more of an effort;
- iii) The more efficient performance of merchants and suppliers to the building trade.

It therefore appears that incentives are necessary to the construction industry. They are required to try to motivate workers to increase production and the quality of work, and they can be used to decrease absenteeism and labour turnover within the industry.

In an attempt to formulate formal or informal incentive schemes by means of behavioural techniques it is necessary to consider those individual and situational variables that influence a person's behaviour.

While/.....

While individual variables do strongly influence the attitudes and behaviour of the individual on site, they are considered short-term constants and incentive schemes are aimed at the use of situational variables.

The surveys previously conducted (Appendices A and B) were aimed at middle to lower management; therefore in a discussion of the motivation of construction workers on site the relevant person to be considered is the site agent or general foreman. Since the behavioural information that was collected also reflected his attitudes, the discussion can be further expanded by incorporating those who are directly influenced by his role as site agent or general foreman.

#### 5.1 MOTIVATING THE SITE AGENT

The importance of motivating the site agent by the use of formal and informal incentive schemes is accentuated by his strong influence on those working on his site and by the strong detachment found to exist between the sites and head office (See Chapter 4 and Ref. 13). The site agent or general foreman's command of the job is therefore considered an important factor influencing productivity on a project (Ref. 35).

MONETARY BONUS INCENTIVES are not generally used to motivate site agents and even an annual bonus, related to the individual's performance, will not directly stimulate any increased effort. However, the use of target-based schemes would provide a means of using monetary bonuses as direct stimulants. This scheme sets certain predetermined targets which the site agent has to meet on his project and the accomplishment of the task results in an immediate payment of the bonus.

The first of certain prerequisites to the target-based schemes are that the targets established must be attainable and that they still require above-average effort. A check must also

be maintained/.....

be maintained to ensure that the site agent does not develop tunnel vision, which would result in his disregarding of other factors, such as work quality or company aims, in an attempt to reach his objective.

Money's value is often regarded as an instrument with which to fulfil other needs in a human's psychological make-up by contributing to his self-actualization, ego, social and safety needs (Ref. 42). As shown in the survey (Appendix A) other NON-ECONOMIC NEEDS also require stimulation.

In analysing the attitudes of supervisory staff on construction projects in the Western Cape (Chapter 3) it was apparent that non-economic needs were poorly satisfied. On-site supervisory staff felt that they:-

- i) Were not given enough scope in their work to utilize their capabilities efficiently;
- ii) Considered themselves detached from the off-site organization and felt that top management has no feeling of empathy for the predicament of site personnel.

Management's motivation of site agents must therefore stress the organizational and social variables. This is more difficult than a plain monetary incentive scheme because it requires a continuous effort by top management.

Incentives should aim at stimulating:-

- a) The efficient use of the capabilities of site agents;
- b) Increased communication with sites to increase downward communication and to foster a feeling of participation in the company, both socially and organizationally.

- a) The EFFICIENT USE/.....

a) The EFFICIENT USE of a site agent's CAPABILITIES can be considered to be dependent on:-

- i) Management's awareness of the site agent's capabilities;
- ii) Giving the site agent the opportunity to use his capabilities;
- iii) Relating the increased use of the site agent's performance to his desired outcomes.

Site agents are often physically detached from site. There is therefore little inter-personal contact between top management and site agents. To ensure that management is aware of site agents' capabilities, files should be kept of their accomplishments, their work and of their other activities related to the work situation. This should be complemented by regular inter-personal contact between top management and site agents.

Therefore, by means of both formal and informal channels, top management should acquaint themselves with the abilities of their men. The next step is to utilize these abilities in order to further the aims of the organization. Top management often perceives a certain role for a site agent and consequently automatically resists the use of the individual in another role.

An example of inefficient use of the capabilities of a site agent is when a slack period occurs during the tailing off or completion of a contract. During this period the site agent or general foreman is under-utilized on site. However, since he is regarded as a 'site man' he will generally not be given the opportunity to fulfil any other function in the organization.

Certain construction/.....

Certain construction supervisors perceive that the role of the general foreman is to involve himself in the details of running his project. This requisite of personal attention to detail results in the general foreman or site agent being unable to attend to the planning, controlling and motivating of his workers.

The better utilization of a man's capabilities is primarily dependent on his superior's attitude and behaviour. The latter is responsible for the fostering, by means of numerous non-economic incentives, of a site agent's efficient use of capabilities. Recognition of a man's ability to perform a function is in itself a stimulant to the individual, and it strengthens the individual's conviction that he can use his capabilities.

In the effort-performance model, effort is a function of the summation of perceived outcomes and the importance of these outcomes. If the site agent believes that his performance will result in the satisfaction of his needs, he will be motivated.

The needs found to be most lacking amongst site agents in the Western Cape were:-

- Increased responsibility
- Promotion or recognition
- More interest in the individual

The satisfaction of these needs will result in the site agent being positively motivated towards performing what he perceives as his job. Apart from inefficient utilization of his capabilities, the other aspect found to be most lacking amongst middle to lower management (Chapter 4) was organizational and social participation.

b) ORGANIZATIONAL/.....

b) ORGANIZATIONAL AND SOCIAL PARTICIPATION of the site agent in the overall function of a firm will partly fulfil some of his outstanding needs and should result in increased effort on his part.

The need to incorporate the site agent into the overall body of the organization was found to be highlighted by (Chapter 3):

- i) The poor downward communication towards the sites;
- ii) The phenomenon of on-site detachment from off-site.

Poor downward communication is partly the result of an inefficient organizational system which provides no incentive for the site agent to participate in the company's overall work and social structure. However, improvement of downward communication systems will not completely bridge the on-site detachment from off-site. Formal organizational schemes are therefore required to integrate the work and social functions of the site agent with the main organization, but must not remove the focus of the site agent's goals from his project.

To stimulate a favourable response from the site agent he should be included in certain overall functions of the organization. This can take the form of active involvement or more passive participation in company activities.

Examples of active involvement would be:

- i) Participating in tendering teams for future work;
- ii) Taking part in African Liaison Committee meetings;
- iii) Involving the site agents in training schemes and work study methods used on site;
- iv) Consulting of site agents regarding the uses of and future capital expenditure on plant.

Passive/.....



Passive involvement could be brought about by:-

- i) Informing site agents of inter-company appointments, promotions and other news often received via the grapevine;
- ii) Circulating magazines on construction and related subjects to the sites;
- iii) Representation at site supervisors' meetings;
- iv) Being included in inter-company events, of both a working and a social nature.

Certain of the above examples, and any other incentives which will stimulate non-economic needs, should be based on merit and this should result in increased effort and performance - otherwise all the stimulants would have the same effect as that achieved in a paternalistic type organization.

Though the rewards must be based on merit, care must be taken to let the site agent believe that the satisfying of his needs, by the use of his capabilities and his participation in the overall organization, is possible. He will then know that functional performance on his part will result in the perceived outcome. This will result in effective motivation of the site agent who will then, by his functional behaviour, directly and indirectly stimulate those over whom he has control on the construction project.

The motivation of skilled and unskilled workers on a medium-sized project is governed predominantly by the site agent and foreman; they, in fact, influence and control the situational variables which affect production. However, though all workers have the same site supervision, the personal variables influencing their behaviour will differ greatly.

The cultural/.....

The cultural background, value systems and education of skilled and unskilled workers, in, for example, the Western Cape, can vary considerably. The approach required to motivate the two groups will therefore be different.

## 5.2 MOTIVATING SKILLED WORKERS

The skilled worker on site perceives the character and policy of the organization through the decisions and behaviour of site supervision. Therefore the controllable variables affecting his behaviour will be predominantly those related to:-

- a) The type and quality of supervision he receives;
- b) His social environment;
- c) Union regulations;
- d) The types of incentives he experiences.

Site supervisors will influence production by the particular mix of the above variables that they achieve. Though the mix required to increase production will vary with the particular situation, certain generalizations can be made - always bearing in mind the relevant limitations.

a) The TYPE OF SUPERVISION will affect artisans in two main ways, viz. their role perception and the amount of effort they put into their work. According to the effort-performance model, these two factors combine multiplicatively with ability to give performance.

$$\begin{array}{ccccc} & & \text{ABILITY} & & \\ & & \text{X} & & \\ \text{EFFORT} & & & & \text{= PERFORMANCE} \\ & & \text{ROLE PERCEPTION} & & \end{array}$$

Therefore no matter what formal training techniques are given to the artisan, the effort and the perceived role will markedly influence their performance.

Where/.....

Where leading hands are used on site in a traditional site hierarchy (Fig. 8) instructions are transmitted to them by the general foremen. They, in turn undertake the allotted task by means of the artisans under their control. The attitude of the leading hand is therefore critical to the performance of the skilled worker. It was noted on a number of sites in the Western Cape that the artisan generally expects the leading hand to allocate a specific task to him by:-

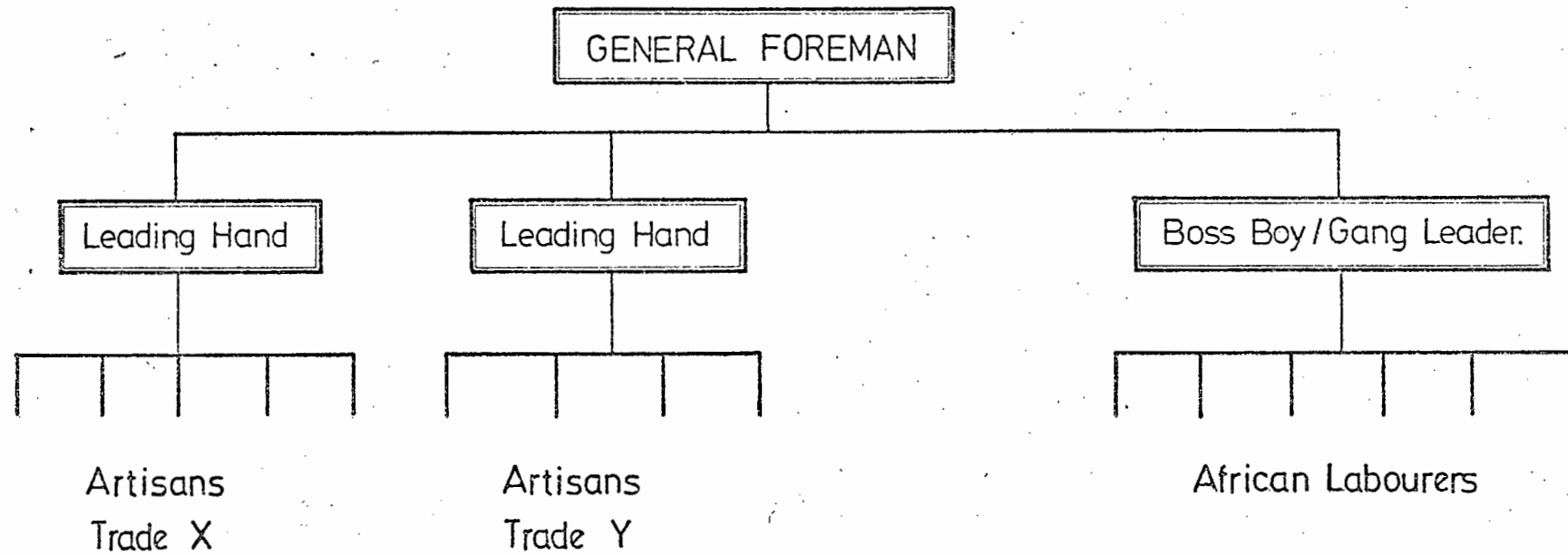
- i) Explaining the task in detail;
- ii) Setting out the work with or without the participation of the artisan;
- iii) Organizing the required materials;
- iv) Providing all ancillary requirements necessary (i.e. scaffold, plant, small tools);
- v) Co-ordinating his activity with sub-contractors or other trades.

The leading hand's perception of his role, his behaviour and attitudes towards the workmen are important factors affecting the artisan's performance.

An example of the use of a non-traditional supervisory system was on a large de-gut and rebuild operation in the centre of Cape Town where the contract was run without leading hands.

The reason for this was that the renovations undertaken did not give any continuity in the performing of any individual task and a large number of leading hands would have been required. The other alternative was to do without leading hands and delegate the authority directly to the artisans.

## Traditional Site Hierarchy



The system/.....

Fig. 8

The system was complemented by the use of young trainees as the 'communicators' within the system. Their role was to:-

- i) Transmit the work requests of the general foreman, with the appropriate drawings and details, to the artisans;
- ii) Consult with the relevant artisan and, together with him, decide on the organizational details of the task;
- iii) Supply feedback to the site agent on the synchronization and difficulties experienced with the task;
- iv) Communicate the requirements of the artisans to various sub-contractors and the unskilled working force.

By this means it was sought to place as much responsibility as possible in the hands of the artisans, to try to train them to think constructively and to co-operate in the construction process (Fig. 9).

The 'communicator' performed some of the functions of the leading hand, but he was unable to do this completely because of his limited experience and lack of status in the eyes of the artisans. The artisan was therefore forced to think, plan his operations and consider other trades affecting his work. The 'communicator' was also given an excellent opportunity to learn from the artisan because of the continuous communication required between the two.

Use of a system without leading hands brought various findings about the artisan to light:-

- i) The artisan in the trade had very little practice and was therefore not used to reading drawings or setting out his own work.

## Site Organisation using Communicators

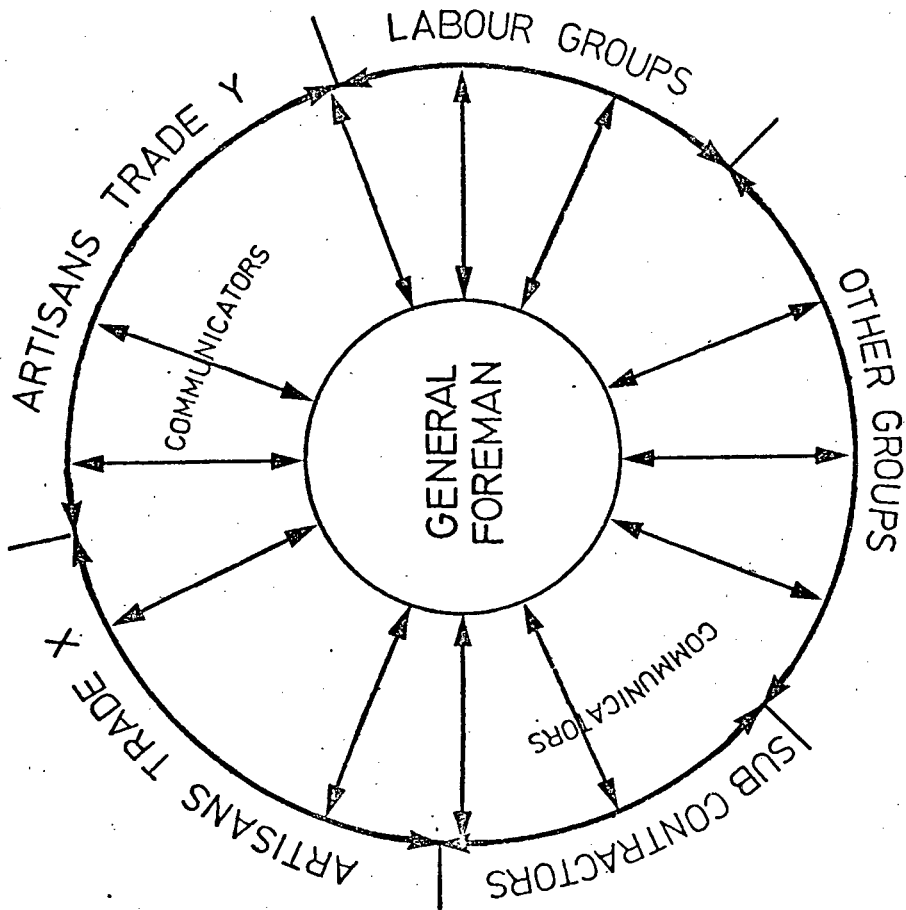


Fig.9

ii). The artisan/.....

- ii) The artisan did not think beyond the simple mechanics of his task. He perceived his role to be similar to that of a machine, the thinking being left to others;
- iii) He consequently did not consider his involvement with other trades or sub-contractors.

The new system used over a period of two years brought about a considerable change in attitude of the artisans. They could be left on their own with a minimum amount of information and supervision to complete their specified tasks. Unfortunately there was no control group with which to gauge the measure of productivity achieved by the artisans under the new scheme. The contract, however, gave a satisfactory profit and all handover deadlines were easily met. The above supervisory system showed that traditional means of supervision are not perforce necessary in the building industry and that other supervision styles can be adopted to optimize the supervisory situation.

b) The next variable, after the type of supervision, which affects the production of the skilled worker on site is his SOCIAL ENVIRONMENT.

Site supervision does not often directly influence the social environment of the artisan off-site. However, the artisan's social environment on the construction site will be influenced by the informal groups of workers which will form on the project and by the attitudes of site supervisory staff.

The social environment of an artisan is thus a factor affected by the type and style of supervision existing on a project. Supervisory staff must therefore take into consideration their effort in the informal organization of the project as well as try to motivate the workers by means of formal incentives.

c) The FORMAL/.....

c) The FORMAL INCENTIVE SCHEMES normally considered suitable to motivate skilled workmen are monetary ones. However, the use of monetary incentive schemes not only has certain practical difficulties, but it must be complemented by non-economic incentives. The requisites of a monetary incentive scheme to stimulate greater effort are therefore that:-

- i) Monetary reward must be a direct result of performance;
- ii) The amount of reward must be related to performance.

These prerequisites require an effective production control system and a modified wage payment scheme, but unfortunately wage bonus schemes are prone to misuse and are thus often viewed with disfavour.

Another difficulty with bonus incentive schemes is that they may be in conflict with the Industrial Council Agreement for the particular region. The Building Industry Agreement for the Western Cape (Ref. 39) prohibits the use of piece work, task work and labour-only contracts. There is, however, a proviso:

Incentive payments are permitted by mutual consent, provided that as a result of the introduction and operation of such a system the remuneration shall not be less than that normally prescribed in the Agreement.

It is therefore apparent that monetary incentive schemes have various problems associated with them. However, they can be used as a tool to stimulate increased performance as long as they are used as part of an overall motivation scheme. For the effective motivation of skilled personnel on site it is necessary to obtain the optimum mix of supervisory style, organizational structure and social environment, together with

the use of/.....



the use of economic stimulants. The supervisory style and organizational structure adopted should take into consideration the individual variables of those supervised, especially in motivating the unskilled worker.

### 5.3 MOTIVATING THE UNSKILLED WORKER

The unskilled worker may have a considerably different cultural background, value systems and education from that of the artisan. Therefore any scheme for motivating the unskilled worker must take into consideration the different individual variables affecting his performance.

Numerous studies have been made of the Black worker and of the factors influencing his behaviour in South Africa (Refs. 19, 33, 34). It must be remembered that it is not safe to assume that leadership styles or incentive schemes proven on construction workers in Western European countries or the United States will always be relevant to South African conditions.

The use of Black labour in the Western Cape is beset by the language problem. Site supervisory staff seldom speak Xhosa and many labourers do not fully understand English or Afrikaans. Communication is therefore channelled through someone who understands both languages.

The role of translator and organizer of the labour force is often performed by the 'boss boy' or African foreman. Unfortunately this brings about a bottleneck in the flow of information to the unskilled workers. This often results in the men all working together in one large group and over-staffing a particular task.

Smaller work groups can be used with unskilled Black labour. However it may be necessary to do away with the 'boss boy' and introduce a number of group leaders, none of whom will have the 'boss boy' status. Alternatively, the 'boss boy' has to be re-educated to perceive his role as the supervisor of a number

of groups of/.....

of groups of workmen who must do independent tasks.

The formation of small semi-independent groups of Black workmen can thus have two advantages:-

- i) An increase in the number of channels of communication and therefore the opportunity for groups to perform different activities simultaneously;
- ii) Job enrichment through variation of the individual tasks performed by the different groups.

On a building project in Cape Town a system of job rotation amongst the labourers was introduced to try and reduce the boredom caused by repeatedly performing the same task. A monetary bonus scheme was simultaneously introduced which awarded weekly bonuses on the following basis:-

- i) The top three workers on the project were given a merit bonus dependent on their performance, no matter with what task they were involved;
- ii) Workers performing a more strenuous task, such as working the paving breakers efficiently, were given a bonus;
- iii) Workers performing more skilled work were given a bonus.

Therefore any unskilled worker who put more effort into his work, either physically or mentally, was rewarded monetarily.

The function of the bonus scheme was not only to relieve boredom and to try to instil a feeling of participation in the overall project, but also to try to give the workers the opportunity to earn extra money by consecutively performing the more strenuous or skilled tasks. Money has a strong influence

on the Black/.....

on the Black worker and, apart from satisfying the physiological needs of the individual, it enables him to gain status in the township and amongst his fellow workers. Yet, while money has a strong appeal amongst Black unskilled workers, the very character of the Black worker makes him susceptible to non-economic incentives (Ref. 34).

The Black township dweller seeks stability in his job. Dr. J.C. de Ridder in his research on township life in South Africa states that the personality of the urban African in South Africa is characterized by a strong feeling of insecurity and anxiety. The company can therefore satisfy the safety need by its attitude to the workers and the implementation of company rules.

The Black worker is particularly sensitive about his status (Ref. 34). Therefore the social status given to the worker on the job may be used as an effective stimulant. In fact, psychosomatic factors are common to the Black worker's culture. This fact must be taken into account by his supervisors; by ensuring a good working climate the supervisor will strongly influence the man's attitude towards his work.

The unskilled worker may thus be motivated to greater performance by strengthening the lines of communication to him and by the use of monetary and non-monetary incentives. The major part of this task is in the hands of the site supervisory personnel. It is therefore important that they be suitably informed and, if necessary, trained to perform this function.

In the above discussion it has been sought to demonstrate how behavioural knowledge and techniques can be incorporated into motivating workers on construction projects. The awareness itself, that motivation of the individual is part of the management process, is an important factor contributing to a

more enlightened/.....

more enlightened construction management approach. This awareness can then be expanded to other uses of behavioural techniques aimed at increasing productivity in construction.

## CHAPTER 6 - CONCLUSION

### 6. CONCLUSION AND RECOMMENDATIONS ON THE USE OF THE BEHAVIOURAL APPROACH TO INCREASE PRODUCTIVITY

Productivity in Construction Contracting has not increased significantly since the 1960's and the attempts to improve it have generally been centered on increased mechanization and the training of labour. The use of behavioural techniques as a means of optimizing the resources available to the contractor have been largely neglected. In the study that was undertaken it was sought to analyse the behavioural, or human, factors which affect the performance of workers in construction contracting organizations.

Behavioural techniques centre on the use of social and organizational variables which affect a person's performance. These variables are used to try and stimulate the individual to increased performance both on the micro and on the macro scale.

An important factor affecting the motivation of the individual on the macro scale is the socio-organizational character of his company; stimulation to increased performance on the micro scale requires a more detailed analysis. Motivation on a micro scale often takes place by means of theoretical behavioural models which define the inter-relationship of factors which influence the individual's performance. But all behavioural models and generalizations need to be complemented with empiric data relevant to a particular situation.

Because of the lack of documented information on behavioural aspects of construction contracting in South Africa, data had to be collected. The data was collected by means of attitude questionnaires, together with a number of in-depth interviews with individuals in the industry.

Due to the difference in structure of main contractor and sub-contractor organizations, different questionnaires were used for the two types of

company/.....

company. The questionnaires aimed at obtaining a response to socio-organizational factors relevant to lower to middle management in construction contracting. Apart from the hierarchical level at which the questionnaires were aimed, the other constant in the analysis was the geographic position chosen, the Western Cape.

Certain recognizable trends were apparent from the data collected on main contractor organizations. The middle to large size contracting companies were bureaucratic in character and top management was generally found to adopt the philosophies of scientific management closely associated with Douglas MacGregor's Theory X assumptions on human behaviour. This basic symptom was seen to be reflected in various other characteristics of the organization.

In analysing the socio-organizational needs of the respondents it was found that those factors most in need of stimulation were promotion, recognition and 'a greater interest being taken in the individual'. Money, a factor often given importance as an incentive, was rated below the abovementioned unfulfilled needs. Coupled with the need for stimulation of non-monetary factors was the general feeling that people felt 'kept in the dark' about happenings in the firm. The above are all symptoms of a bureaucratic organization.

The bureaucratic character and consequent organizational inflexibility of the construction companies made them more dependent on their own formally instituted communication processes. Unfortunately the communication process was found to be poor, largely because of the absence of an effective feedback loop. The poor communication process was also found to result in a strong and identifiable phenomenon: on-site detachment from off-site.

Two factors contribute to the phenomenon of on-site detachment from off-site: the traditional departmentalization of bureaucratic organizations, and the poor formal communication process which is not suitable for the continuous recycling of information. The belief that was found to exist in site personnel, that off-site supporting departments, and particularly top management, are out of contact

with what/.....

schemes required to motivate construction personnel in main contractors' organizations on site were therefore investigated.

The motivation of the site agent or general foreman is important because of his direct influence on the workers on a construction project. His behaviour can be influenced by use of monetary and non-monetary incentives. Because of the lack of non-monetary incentives apparent in contracting these were analysed under two main headings: efficient use of capabilities, and social participation in the overall organization. By means of the incentives one also tries to stimulate functional behaviour of the general foreman in his supervisory role.

The motivation of skilled and unskilled workers is largely dependent on the structure of the organization in which they are employed and on the type of supervision they receive. Resistance to change is a strong factor against the use of different supervisory styles in construction but non-traditional supervisory schemes have been used successfully. The utilization of behavioural incentives in the motivation of skilled and unskilled workers on the construction project was investigated and found to be feasible.

Behavioural techniques were found to be largely disregarded as stimulants to increased performance in construction contracting. Any significant overall increase in productivity within the industry, however, will require the use of behavioural techniques together with those of scientific management. It is therefore necessary that supervisors at all levels should be made aware of the necessity of maximizing the abilities of the individual.

For the supervisor to maximize his available resources he must be made aware of behavioural problems in the industry. He should then use this awareness in the development and application of formal and informal incentives amongst his workers.

Due to the/.....

Due to the limitations relevant to any particular empiric behavioural study, different situations in construction require the collection of new data. This is particularly relevant to the construction industry in South Africa with its great variety of individual and situational variables found on different sites.

It is therefore necessary for numerous behavioural studies to be undertaken. The compilation of data, together with the awareness that it will bring regarding the behaviour of individuals in construction, will provide a new means for increasing productivity in the industry.

References/.....



REFERENCES

- Ref. 1) International Labour Office, Geneva, Introduction to Work Study, Revised Edition 1974.
- Ref. 2) Hodgetts, R.M. Management Theory Process and Practice, W.B. Saunders Company 1975
- Ref. 3) Evenwel, J.K. Productivity, Some Hard Facts, Pages 131 - 149, Construction in Southern Africa, August 1974.
- Ref. 4) Evenwel, J.K. Modern Building Methods, National Building Research Institute, 1971.
- Ref. 5) Department of Statistics, South Africa Statistics 1976. Compiled by Department of Statistics, Pretoria 1976.
- Ref. 6) Department of Statistics, Bulletin of Statistics, Vol. 10 No. 4, Department of Statistics, Pretoria, December 1976.
- Ref. 7) Foster, R. Research for Better Building Men, Money and Machines, Pages 89 - 95, Construction in Southern Africa, May 1974.
- Ref. 8) Kilian, W.F. and Snyman, G.J.J. B.E.R. Building Survey No. 32, Bureau for Economic Research, University of Stellenbosch, January 1977.
- Ref. 9) Schumaker, E.F. Small is Beautiful, Blond & Briggs, 1973.
- Ref. 10) Boyazoglu, S. An Attack on Construction's Holy Cows, Pages 12 - 15, Construction in Southern Africa, January 1975.

Ref. 11)/.....

- Ref. 11) In-Company Training Policies, Pages 39 - 40, The Civil Engineering Contractor, September 1976.
- Ref. 12) Training in the Industry Comes of Age, Page 39, The Civil Engineering Contractor, December 1976.
- Ref. 13) Foreman Gives Views on Industry, Pages 43 - 45, The Civil Engineering Contractor, June 1976.
- Ref. 14) Wages of Sin, Pages 27 - 29, Construction in Southern Africa, November 1976.
- Ref. 15) Hartley, J. Productivity and Conditions Boost with Group Assembly, Pages 38 - 41, The Engineer, 7 October 1976.
- Ref. 16) Hartley, J. Making the Most from Your Existing Assets, Pages 24 - 25, The Engineer, 10 June 1976.
- Ref. 17) Douglas, J. Success in Training and Jobs will be Difficult but Crucial, Page 53, The Engineer, 11 November 1976.
- Ref. 18) McLain, L. A Scheme is Needed to Fill Better the Role of Sandwich Courses, Pages 56 - 57, The Engineer, 14 October 1976.
- Ref. 19) Hartshorne, K.B. The Education and Training of the Black Worker, Pages 63 - 67, The South African Mechanical Engineer, Vol. 25, March 1975.
- Ref. 20) McNally, H. and Havers, J. Labour Productivity in the Construction Industry, Pages 1 - 11, Journal of Construction Division ASCE, No. C02, September 1967.
- Ref. 21) Sprinkle, H.B. Analysis of Time-Lapse Construction Films, Pages 183 - 199, Journal of Construction Division ASCE, No. C02, September 1972.

Ref. 22)/.....

- Ref. 22) Schroder, C.R. Motivation of Construction Craftsmen, Pages 257 - 273, Journal of Construction Division ASCE, Vol. 98 No. C02, September 1972.
- Ref. 23) Scott, D.F. Effective Contract Administration in Construction Management, Pages 117 - 132, Journal of Construction Division ASCE No. C02, June 1974.
- Ref. 24) Borcharding, J.D. and Oglesby, C. Construction Productivity and Job Satisfaction, Pages 413 - 431, Journal of Construction Division ASCE, Vol. 100, No. C03, September 1974.
- Ref. 25) Borcharding, J.D. and Oglesby, C. Job Dissatisfaction in Construction Work, Pages 415 - 433, Journal of Construction Division ASCE, Vol. 101 No C02, June 1975.
- Ref. 26) Borcharding, J.D. Discussion: 'Motivation of Construction Craftsmen', Pages 219 - 221, Journal of Construction Division ASCE, No. C01, July 1973.
- Ref. 27) Construction Productivity - How to Improve It?, Pages 57 - 59, Civil Engineering ASCE, October 1976.
- Ref. 28) Murray, J.A. The Contribution of the S.A.B.S. to the Improved Efficiency of the Building and Allied Industries, Paper delivered at Cape Building Conference on 2 and 3 May 1977.
- Ref. 29) Lundall, C.M. The Contribution of the N.P.I. Towards Greater Efficiency in the Building and Allied Industries, Paper delivered at Cape Building Conference on 2 and 3 May 1977.
- Ref. 30) McCormick, E.J. and Tiffin, J. Industrial Psychology, George Allen and Unwin, 6th Edition 1975.

Ref. 31)/.....

- Ref. 31) Brown, J.A.C. The Social Psychology of Industry, Penguin Books, England 1973.
- Ref. 32) Vroom, V.H. and Deci, E.L. Management and Motivation, Penguin Books, England 1975.
- Ref. 33) Orpen, C. Productivity and Black Workers in South Africa, Juta, Cape Town 1976.
- Ref. 34) Silberbauer, E.R. Understanding and Motivating the African Worker, Hugh Kearthland, Johannesburg 1975.
- Ref. 35) Thursby, H. Incentive Schemes from a Foreman's Viewpoint, Pages 43 - 45, World Construction, April 1977.
- Ref. 36) Weame, S.H. Principles of Engineering Organization, Edward Arnold, London 1973.
- Ref. 37) Weame, S.H. Control of Engineering Projects, Edward Arnold, London 1974.
- Ref. 38) Productivity on the Construction Site, Pages 74 - 79, Civil Engineering ASCE, January 1977.
- Ref. 39) Agreement for the Cape Peninsula Building Industry, Western Province, South African Government Gazette, No. 2378, 8 October 1976.
- Ref. 40) Merkel, H. A Builder's Labour Cost on Paper and on Site, The South African Builder, December 1973.
- Ref. 41) Morse, N.C. and Weiss, R.S. The Function and Meaning of Work and the Job, Pages 191 - 198, American Sociological Review, Vol. 20, 1955.
- Ref. 42) Maslow, A.H. A Theory of Human Motivation, Pages 370 - 396, Psychological Review, Vol. 50, 1943.

Ref. 43)/.....

- Ref. 43) Lawler, E.E. and Porter, L. Antecedent Attitudes of Effective Managerial Performance, Pages 122 - 142, Organizational Behaviour and Human Performance, Vol. 2, 1967.
- Ref. 44) Lawler, E.E. Ability as a Moderator of the Relationship between Job Attitudes and Job Performance, Personnel Psychology, Vol. 19, 1966.
- Ref. 45) Vroom, V.H. The Handbook of Social Psychology, Addison - Wesley, Vol. 5, 2nd Edition 1969.
- Ref. 46) Brayfield, A.H. and Crockett, W.H. Employee Attitudes and Employee Performance, Pages 396 - 424, Vol. 52, 1955.
- Ref. 47) Herzberg, F. Work and the Nature of Man, World Publishing Company, 1966.
- Ref. 48) Lockyer, K.G. Factory and Production Management, Pitman, London, Third Edition 1974.

APPENDIX A

8. SURVEY ON CONSTRUCTION ORGANIZATIONS

8.1 QUESTIONNAIRE

8.2 NUMERICAL RESULTS

8.3 GRAPHICAL RESULTS

## UNIVERSITY OF CAPE TOWN

(WITH WHICH IS INCORPORATED THE SOUTH AFRICAN COLLEGE)



INDUSTRIAL ADMINISTRATION PROGRAMME

Private Bag

Rondebosch  
7700

Dept. of Mechanical Engineering

---

survey on  
construction organizations

NOTE Please mark appropriate answer or comment  
with a cross.

JOB DESCRIPTION OF CONTRIBUTOR

WORKING

on site

☐

off site

☐

both

☐

AS

site agent

☐

general foreman

☐

quantity surveyor

☐

planner

☐

buyer

☐

estimator

☐

trainee

☐

other

☐

---

NOTE Please complete as soon as possible

---

- |   |  |
|---|--|
| 1. The <u>AIMS</u> of my firm<br>are <u>CLEAR TO ME</u>   | strongly agree <input type="checkbox"/><br>agree <input type="checkbox"/><br>undecided <input type="checkbox"/><br>disagree <input type="checkbox"/><br>strongly disagree <input type="checkbox"/> |
| 2. These <u>AIMS</u> were made <u>KNOWN</u><br>to me:<br><br>via the grapevine <input type="checkbox"/><br>verbally by my superiors <input type="checkbox"/><br>in writing by my superiors <input type="checkbox"/><br>uncertain of exact way. <input type="checkbox"/> |  |
| 3. I would <u>WORK HARDER</u> over a<br><u>LONG PERIOD</u> of time for more<br><u>MONEY</u>   | strongly agree <input type="checkbox"/><br>agree <input type="checkbox"/><br>undecided <input type="checkbox"/><br>disagree <input type="checkbox"/><br>strongly disagree <input type="checkbox"/> |
| 4. I would <u>WORK HARDER</u> over a<br><u>LONG PERIOD</u> of time for<br><u>PROMOTION</u> or <u>RECOGNITION</u>  | strongly agree <input type="checkbox"/><br>agree <input type="checkbox"/><br>undecided <input type="checkbox"/><br>disagree <input type="checkbox"/><br>strongly disagree <input type="checkbox"/> |
| 5. I would <u>WORK HARDER</u> over a<br><u>LONG PERIOD</u> of time if under<br>the constant <u>FEAR</u> of <u>LOSING</u><br>my <u>JOB</u>   | strongly agree <input type="checkbox"/><br>agree <input type="checkbox"/><br>undecided <input type="checkbox"/><br>disagree <input type="checkbox"/><br>strongly disagree <input type="checkbox"/> |
| 6. I would <u>WORK HARDER</u> over a<br><u>LONG PERIOD</u> of time if my<br><u>SUPERIORS TOOK MORE INTEREST</u><br><u>IN</u> my <u>WORK</u>   | strongly agree <input type="checkbox"/><br>agree <input type="checkbox"/><br>undecided <input type="checkbox"/><br>disagree <input type="checkbox"/><br>strongly disagree <input type="checkbox"/> |



7. I feel KEPT IN THE DARK about happenings in the firm.
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐
8. It is nicer to SPEAK ABOUT MY WORK to people from:
- within the organization ☐  
outside the firm ☐
9. My FAVOURITE means of COMMUNICATION is
- mostly in written form ☐  
I have no favourite ☐  
mostly in verbal form ☐
10. INSTRUCTIONS I received FROM ABOVE are OFTEN IRRELEVANT to existing conditions.
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐
11. It is DIFFICULT to make MANAGEMENT AWARE of my problems.
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐
12. MANAGEMENT COMMUNICATES mostly through written MEMOS.
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐

13. I could IF REQUIRED DO  
a lot MORE WORK than  
that expected of me.

strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐

14. The RESPONSIBILITY presently  
given to me is TOO GREAT.

strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐

15. My immediate SUPERIOR  
tries to do TOO MUCH  
himself.

strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐

16. Usually site agents and general  
foreman are OFFICIALLY INFORMED  
OF PRICES and rates on their  
jobs.

Yes ☐  
No ☐  
Sometimes ☐

17. A lot of PAPERWORK required  
at HEAD OFFICE is UNNECESSARY.

strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐

18. STAFF ON SITE generally SHOW  
more ENTHUSIASM for their  
work.

strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐

This portion to be completed by SITE PERSONNEL ONLY

19. MANAGEMENT shows an INTEREST in ME and PROBLEMS on site.

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

20. I prefer: site work  
office work  
indifferent

☐  
☐  
☐

SUBCONTRACTORS:

21. SUBCONTRACTORS are generally EASY TO DEAL with ABOUT their WORK.

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

22. SUBCONTRACTORS WORK HARDER THAN the MAIN CONTRACTOR on site.

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

23. SUBCONTRACTORS are MORE ORGANIZED than the MAIN CONTRACTOR.

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

24. I feel an OBLIGATION to CHECK the QUALITY OF WORK of SUBCONTRACTORS.

yes always  
often  
undecided  
sometimes  
no never

☐  
☐  
☐  
☐  
☐

## 8.2 NUMERICAL RESULTS

Numerical results to attitude questionnaire (8.1) obtained by giving weighted values to answers to the statements.

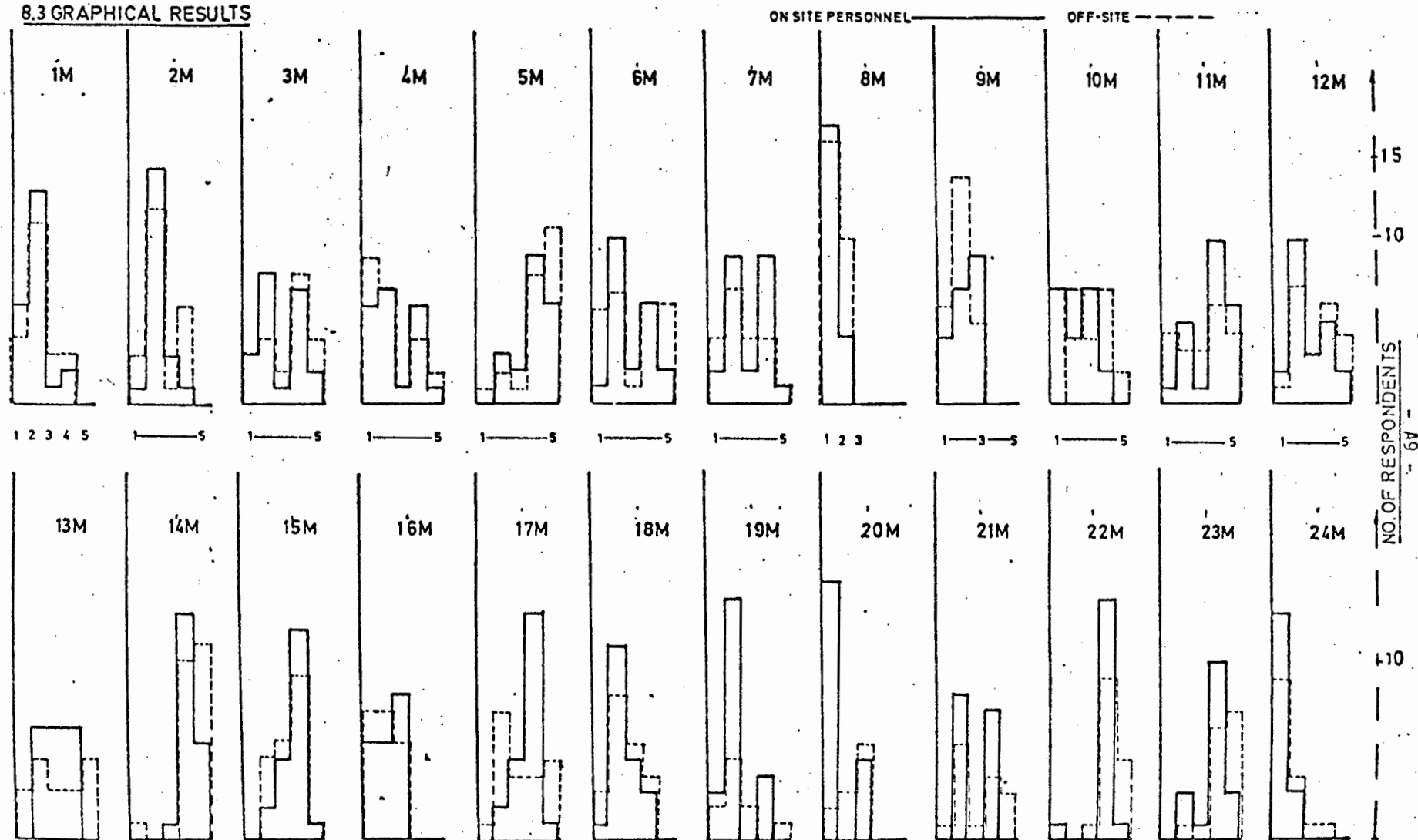
### Weighted values:

Strongly agree	= +2
Agree	= +1
Undecided	= 0
Disagree	= -1
Strongly disagree	= -2

<u>Statement Number</u>		<u>Weighted Result</u>	
		<u>on-site</u>	<u>total</u>
1		+23	+39
2	via the grapevine	1	4
	verbally by my superiors	15	27
	in writing by my superiors	3	4
	uncertain of exact way	1	7
3		+3	+1
4		+11	+28
5		-18	-44
6		+4	+5
7		+2	+11
8	within	17	33
	outside	4	14
9	written	4	9
	no favourite	7	20
	verbal	9	13
10		-4	-17
11		-15	-18
12		+5	0
13		0	-3

<u>Statement Number</u>		<u>Weighted Result</u>	
		<u>on-site</u>	<u>total</u>
14		-26	-55
15		-14	-21
16	Yes	6	14
	No	6	14
	Sometimes	9	15
17		-12	-16
18		+11	+22
19		+17	+24
20	site work	16	18
	office work	0	3
	indifferent	5	11

# 8.3 GRAPHICAL RESULTS



APPENDIX B

9. SURVEY ON SUB-CONTRACTORS IN CONSTRUCTION

9.1 QUESTIONNAIRE

9.2 NUMERICAL RESULTS

9.3 GRAPHICAL RESULTS

## UNIVERSITY OF CAPE TOWN

(WITH WHICH IS INCORPORATED THE SOUTH AFRICAN COLLEGE)



INDUSTRIAL ADMINISTRATION PROGRAMME

Private Bag

Rondebosch  
7700

Dept. of Mechanical Engineering

---

## survey on subcontractors

## in construction

NOTE Please mark appropriate answer or comment  
with a cross.

### JOB DESCRIPTION OF CONTRIBUTOR

#### WORKING

mostly on site  
mostly off site  
both

☐  
☐  
☐

#### AS

division manager  
supervisor  
site supervisor  
foreman  
senior artisan  
estimator  
planner  
buyer  
trainee  
other

☐  
☐  
☐  
☐  
☐  
☐  
☐  
☐  
☐  
☐  
☐

---

Note - Please complete as soon as possible

---



- |  |  |
|--|--|
| 1. The <u>AIMS</u> of my firm are<br><u>CLEAR TO ME</u>  | strongly agree <input type="checkbox"/>    |
|  | agree <input type="checkbox"/>             |
|  | undecided <input type="checkbox"/>         |
|  | disagree <input type="checkbox"/>          |
|  | strongly disagree <input type="checkbox"/> |
| 2. If required I <u>COULD DO</u> a lot<br><u>MORE WORK</u> than <u>EXPECTED</u> of me  | strongly agree <input type="checkbox"/>    |
|  | agree <input type="checkbox"/>             |
|  | undecided <input type="checkbox"/>         |
|  | disagree <input type="checkbox"/>          |
|  | strongly disagree <input type="checkbox"/> |
| 3. I <u>ENJOY</u> being <u>ASSOCIATED</u> with<br><u>CERTAIN CONSTRUCTION PROJECTS</u><br>more than with others                            | strongly agree <input type="checkbox"/>    |
|  | agree <input type="checkbox"/>             |
|  | undecided <input type="checkbox"/>         |
|  | disagree <input type="checkbox"/>          |
|  | strongly disagree <input type="checkbox"/> |
| 4. I <u>PREFER PROJECTS</u> where<br><u>CONTROL</u> by the main contractor<br>is <u>STRICT</u>   | strongly agree <input type="checkbox"/>    |
|  | agree <input type="checkbox"/>             |
|  | undecided <input type="checkbox"/>         |
|  | disagree <input type="checkbox"/>          |
|  | strongly disagree <input type="checkbox"/> |
| 5. I <u>PREFER PROJECTS</u> where the<br>main contractor shows <u>LITTLE</u><br><u>INTEREST</u> in exactly <u>WHAT I'M</u><br><u>DOING</u> | strongly agree <input type="checkbox"/>    |
|  | agree <input type="checkbox"/>             |
|  | undecided <input type="checkbox"/>         |
|  | disagree <input type="checkbox"/>          |
|  | strongly disagree <input type="checkbox"/> |
| 6. I <u>PREFER PROJECTS</u> where I<br><u>CAN WORK WHERE</u> and <u>WHEN</u><br><u>I WANT</u>  | strongly agree <input type="checkbox"/>    |
|  | agree <input type="checkbox"/>             |
|  | undecided <input type="checkbox"/>         |
|  | disagree <input type="checkbox"/>          |
|  | strongly disagree <input type="checkbox"/> |

7. I feel that I am GIVEN  
TOO MUCH RESPONSIBILITY  
in my work

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

8. It is NICER to SPEAK about  
MY WORK to people from:

within the organization  
outside the firm

☐  
☐

9. I most often find INSTRUCTIONS  
which come from ABOVE MEANINGFUL

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

10. The MAIN CONTRACTOR gives  
me ADEQUATE WARNING of  
when I'm NEEDED on site

100% of the time  
75% " " "  
50% " " "  
25% " " "  
0% " " "

☐  
☐  
☐  
☐  
☐

11. MEN ON SITE often WORK  
as much as an hour LESS  
than the ALLOTTED TIME

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

12. I would WORK HARDER over  
a LONG PERIOD of time for  
MORE MONEY

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

13. I would WORK HARDER over a  
LONG PERIOD of time for more  
PROMOTION OR RECOGNITION
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐
14. I would WORK HARDER over a  
LONG PERIOD of time if under  
the CONSTANT FEAR OF LOSING  
my JOB
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐
15. I would WORK HARDER over a  
LONG PERIOD of time if my  
SUPERIORS took MORE  
INTEREST in MY WORK
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐
16. The way the MAIN CONTRACTOR  
THINKS and BEHAVES greatly  
AFFECTS the PRODUCTION of my  
men on site
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐
17. OVERTIME without an INCREASE  
in SUPERVISION DECREASES  
PRODUCTIVITY greatly
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐
18. I would LIKE the MAIN  
CONTRACTOR to take MORE  
INTEREST in MY MEN on  
site
- strongly agree ☐  
agree ☐  
undecided ☐  
disagree ☐  
strongly disagree ☐

19. The main contractor often CALLS  
me ON SITE TOO EARLY

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

20. The men on site LOSE a SIGNIFICANT  
amount of TIME because of the LACK  
of MATERIALS, TOOLS or INFORMATION

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

21. My FIRM is generally MORE  
ORGANIZED than the MAIN CONTRACTOR

strongly agree  
agree  
undecided  
disagree  
strongly disagree

☐  
☐  
☐  
☐  
☐

22. If I HAD A CHOICE I would  
GET OUT OF CONTRACTING

YES

☐

NO

☐

23. I DISAPPOINT the MAIN  
CONTRACTOR by MY PERFORMANCE

100% of the time

☐

75% " " "

☐

50% " " "

☐

25% " " "

☐

0% " " "

☐

24. The CONTRACTOR'S MAIN COMPLAINT  
about me is:

being behind schedule  
poor quality of work  
being disorganized  
not caring about the job  
no complaint  
none of these

☐  
☐  
☐  
☐  
☐  
☐

## 9.2 NUMERICAL RESULTS

Numerical results to attitude questionnaire (9.1) obtained by giving weighted values to answers to the statements.

### Weighted values:

Strongly agree	= +2
Agree	= +1
Undecided	= 0
Disagree	= -1
Strongly disagree	= -2

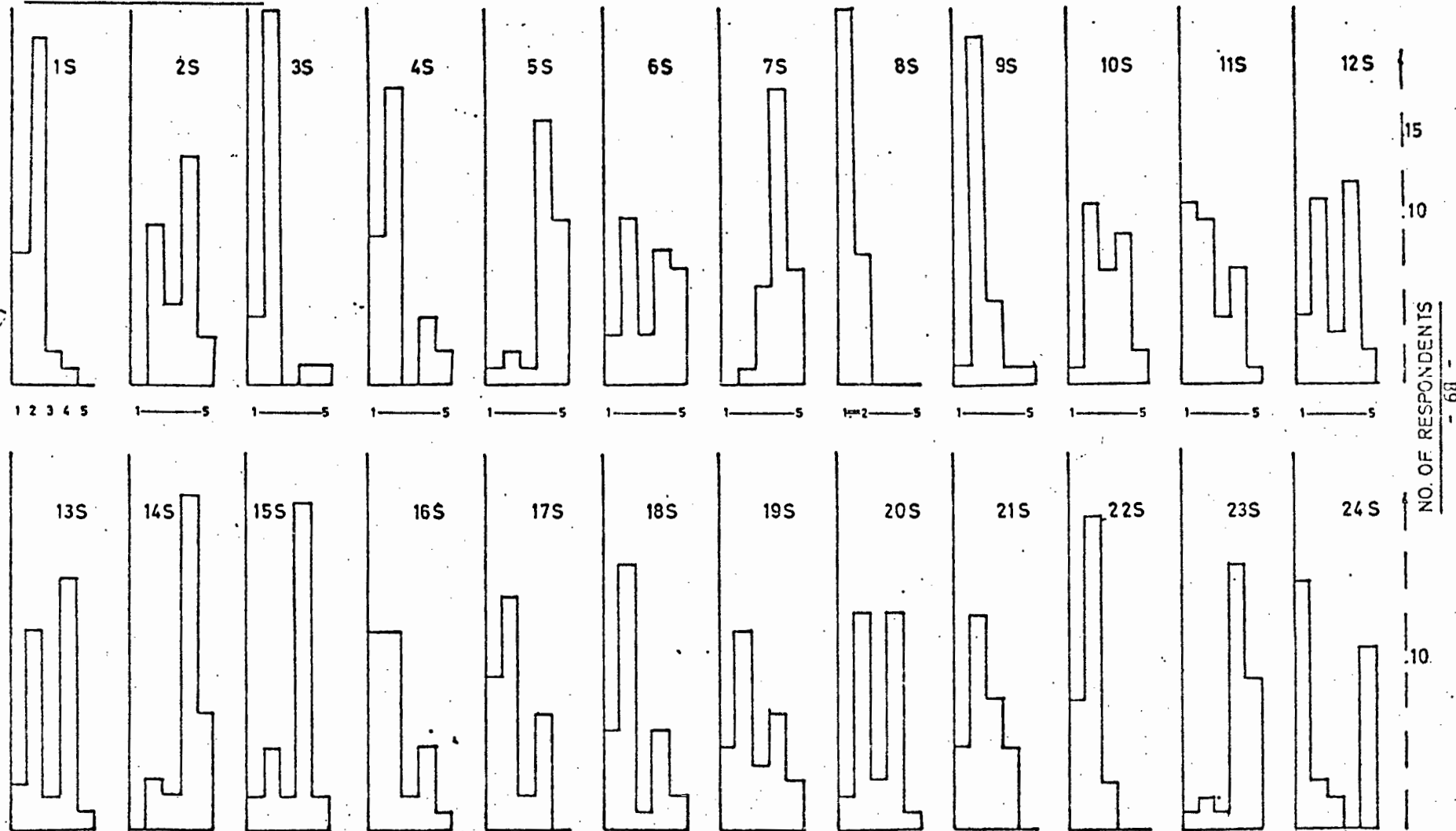
<u>Statement Number</u>	<u>Weighted Result</u>
1	+36
2	-10
3	+30
4	+24
5	-30
6	-12
7	-32
8	within 24, outside 8
9	+21
10	more than 50% = 12, less than = 18
11	+23
12	+3
13	+7
14	-25
15	-15
16	+29
17	+25
18	+18
19	+9
20	+2
21	+18

Statement Number

Weighted Result

22	Yes	8	No	21	undecided	3
23	100%	= 2				
	75%	= 1				
	50%	= 2				
	25%	= 16				
	0%	= 9				
24	being behind schedule =					15
	poor quality of work =					3
	being disorganized =					2
	not caring about the job =					0
	no complaint =					0
	none of these =					11

# 9.3 GRAPHICAL RESULTS



4 JAN 1960  
4 JAN 1960